(12) **INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)**

(54) **Title: IMPLEMENTATION OF CALL SETUP PROCEDURES WITH SEPARATION OF CALL CONTROL AND BEARER CONTROL**
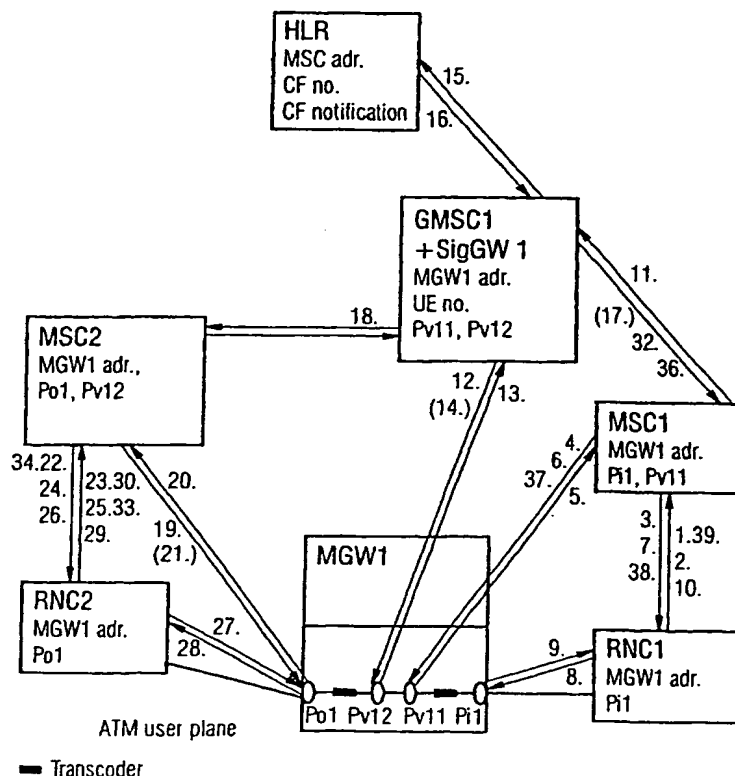
(57) **Abstract:** The invention herein relates to implementation of basic call set-up for GSM/UMTS core networks, including supplementary services CFU, CFB, CFNREA, CFNRY, CW, HOLD and MPTY, with transporting Media Gateway address and logical point coding and framing information in a forward direction in cellular networks with separation of call control and bearer control. Call set-up is described in various traffic cases.

WO 01/13657 A1

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IMPLEMENTATION OF CALL SETUP PROCEDURES WITH SEPARATION OF CALL CONTROL AND BEARER CONTROL

BACKGROUND OF THE INVENTION

A conventional GSM (Global System for Mobile Communications) or UMTS (Universal Mobile Telecommunications Service) core network provides bearer control and call control. The bearer control is the aspect of signaling related to the control of the selection of a path through the transmission network and utilizing (reserving, releasing and setting up) the required resources. The call control is the aspect of signaling related to the subscriber and service control, taking, e. g., the subscriber state into consideration.

In the existing implementations of N-ISDN (Integrated Services Digital Network) the call control and the bearer control are integral with one another. A user plane is associated directly with the control servers, such as MSCs(Mobile Services switching Centres) and GMSCs (Gateway Mobile Services switching Centres). Thus, the control nodes implement both application logic for signaling and the user plane.

The present invention is directed to separation of the call control and the bearer control.

Summary of the Invention

For implementation of GSM and UMTS core networks there is a new approach to separate call control and bearer control.

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In accordance with the invention, with the implementation of separation between call and bearer control, the following features are described:

Transfer the media gateway address, a termination and possibly the chosen transcoder in a forward direction. With transferring the transcoder in the forward direction TFO (tandem free operation) or TrFO (transcoder free operation) is possible.

The application software is independent from the used transmission technology, e. g. STM, ATM, IP.

Changes to call control and bearer control signaling to achieve the optimized user plane set up.

Usage of logical points in the media gateway to allow different control servers to control one media gateway.

Giving a MSC, TSC server the possibility to control several media gateways by allocating one PC per media gateway in the control node.

The user plane routing for call set-up is optimized significantly.

The user plane routing for supplementary services CFNREA, CFB, CFNRY, CFU is optimized significantly.

The user plane routing for supplementary services CW, HOLD is optimized significantly.

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Only one media gateway is used if the call stays inside one network or goes over one network border. If the call goes over two network boarders, then two MGWs are involved, each at the edge to the network.

The user plane pipe size is optimized by transferring coded (compressed) user plane to the edge of the network or between two MGWs, e. g. for MPTY calls

Allowing of pooling of conference call devices in MGWs.

Combining different coded speech streams to one MPTY.

Further features and advantages of the invention will be readily apparent from the following specification and the drawings.

Brief Description of the Drawings

Figure 1 is a block diagram illustrating basic call set-up for a call from UE to UE, media gateway address being transported in the forward direction;

Figure 2 is a block diagram illustrating basic call set-up for a call to UE, media gateway address being transported in the forward direction;

Figure 3 is a block diagram illustrating basic call set-up for call forwarding in GMSC to an ISDN no., media gateway address being transported in the forward direction;

Figure 4 is a block diagram illustrating basic call set-up for call forwarding in GMSC to UE no., media gateway address being transported in the forward direction;

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Figure 5 is a block diagram illustrating basic call set-up for a call from UE with call forwarding in GMSC to UE, media gateway address being transported in the forward direction;

Figure 6 is a block diagram illustrating basic call set-up for call forwarding in MSC to an ISDN number, media gateway address being transported in the forward direction;

Figure 7 is a block diagram illustrating basic call set-up for call waiting and accepting the waiting call in different MGWs, media gateway address being transported in the forward direction;

Figure 8 is a block diagram illustrating basic call set-up for call waiting and accepting the waiting call in one MGW, media gateway address being transported in the forward direction;

Figure 9 is a block diagram illustrating basic call set-up for a MPTY call, media gateway address being transported in the forward direction;

Figure 10 is a block diagram illustrating basic call set-up for call forwarding in MSC to an ISDN number, the MSC setting the connection between MGW1 and media gateway MGW2;

Figure 11 is a block diagram illustrating basic call set-up for call waiting and hold; and

Figure 12 is a block diagram illustrating basic call set-up for a MPTY call with CCDs only in MGW3.

Description

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The present invention relates to enabling and optimizing call set-up in a telecommunication network with separated call control and bearer control, i.e., set up of a payload connection. The separation of call control and payload transmission means that the signaling between control nodes like MSCs, GMSCs and TSCs takes a different way through the network than the payload. This enables the telecommunication network to perform an optimal routing for the payload, using a minimum of resources. Depending on the call case, originating call, terminating call, internal call or transit call, there are only one or maximally two media gateway necessary.

The invention particularly relates to a method comprising the transmission of an identification of a selected media gateway in a forward direction. That is, the first control node or the

second control node selects the media gateway depending on:

- the call origin;

- the call destination (important for the selection of the terminating control node

transit switch or MSC, and for the coding decoding); or

- the required service (voice, fax or else),

for all call cases. In some call cases, further information can be relevant for the selection of

a MGW, such as:

- the invoked service, e.g. CFB;

- the coding of the payload (in the case of compressed voice it is sensible to   keep the voice data compressed throughout the network to save transmission capacity); or

- the framing of the calls.

The invention herein relates to implementation of basic call setup, GSM/UMTS supplementary services CFU, CFB, CFNREA, CFNRY, CW, HOLD and MPTY with transporting a media gateway address, a logical point, the chosen coding type and the chosen framing type in a forward direction in networks with separation of call control and bearer control. Call set-up is described in various traffic cases, each illustrated in one of the figures. Each of the figures is a block diagram of a wireless communication system, such as a GSM or UMTS core network, with directional arrows illustrating control signaling between control servers and with MGWs during call set-up for the different traffic cases. The written description herein describes information conveyed in each signal. The particular signal is identified herein and in the drawing with a reference numeral.

Many of the calls in the traffic cases described herein involve a mobile terminal or a fixed terminal, for example a fax, a PC, or a phone that is located within the network. Such a mobile terminal is referred to herein as User Equipment (UE). The UE communicates with the network via an RNC (Radio Network Controller) using Radio Resource Control (RRC) protocol.

A logical point is a reference locally generated by a media gateway and only with the media gateway address valid to identify a connection in the control servers e. g. MSC/VLR

(MSC/Visitor Location Register), GMSC, TSC and in the RNC. For this purpose a logical point P in a first MGW1 is reserved. This reserved point is sent back in a DCP resource response message to the control server and passed on from this control server to another media gateway MGW2 or RNC, which shall set up an AAL2 connection. In this set up the logical point P is included to identify to which reserved resource in a MGW1 the connection shall be set up. The logical point is equivalent to a termination used in the H.GCP protocol standardized by ITU.

A control node, such as one of the control servers, discussed above, provides the application logic. The strict separation of the application logic from the user plane handling allows intensive application development and execution. In the described system the control nodes GMSC, MSC, TSC and home location register HLR (only signaling) exist. The interfaces of the control nodes are, e.g., N-ISUP, for call control signaling, DCP signaling for media gateway control and MAP for transferring connectionless signaling between control servers.

A media gateway (MGW) modifies or switches the user plane. It performs operations such as announcement generation, tone generation, echo cancellation, modem handling for data calls, frame handling and CODEC (transcoder) handling for speech calls.

A signaling gateway (GW) performs bearer conversion of signaling messages. In UMTS with an ATM core network and ISDN network interworking a conversion from ATM/AAL5 to MTP is done in the signaling gateway. The signaling GW relays the N-ISUP signaling and

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exchanges the lower transport layer which is carrying the signaling. Therefore the signaling GW is always collocated with e. g. a GMSC or TSC server.

· The backbone network transfers the user plane and the control signaling and can, e.g., be based on STM, ATM or IP. The media gateway is the edge node of the backbone network.

The following mnemonics, in addition to others which are well known, are used herein:

AAL2	ATM Adaption Layer Type 2
ATM	Asynchronous Transfer Mode
BICC	Bearer Independent Call Control
CCD	Conference Call Device
CIC	Circuit Identity Code
CFB	Call Forwarding Busy
CFNREA	Call Forwarding Not REAchable
CFNRY	Call Forwarding No ReplY
CFU	Call Forwarding Unconditional
CM	Connection Management
CW	Call Waiting Supplementary Service
DCP	Device Control Protocol, e. g. X-CP
DPC	Destination Point Code

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DTAP	Direct Transfer Application Part
GMSC	Gateway MSC
HLR	Home Location Register
HOLD	Call Hold Supplementary Service
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
MAP	Mobile Application Part
MGW	Media Gateway
MSC	Mobile Services Switching Center
MPTY	MultiparTY Supplementary Service
OPC	Originating Point Code
PC	Point Code
P	Logical Point
RANAP	Radio Access Network Application Part
RNC	Radio Network Controller
SigGW	Signaling Gateway
STM	Synchronous Transfer Mode
TSC	Transit Switching Center

UE   User Equipment (mobile)

In the new network architecture described herein, N-ISDN is used for call control, while STM, AAL2 or IP are used for bearer control and usage of the user plane.

The generation of control tones are omitted in this description and shall be handled in other known manners.

The media gateway address can be transported on BICC, ISDN e. g., as a sublayer transport address. To find the TSC and/or the media gateway address, some IN service, the routing analyse or the B-number analyse are used. The TSC is then chosen for an outgoing call to the ISDN. The media gateway is chosen based on capabilities required for handling the call, e. g. which devices such as CODECs, coding, compression, framing scheme, announcement machines, tone senders, or modems are required. In the examples, for simplification, only the B-number analyse is mentioned. The selection depends mainly on the destination. Depending on the destination a group of MGWs with different capabilities can be found. Then a media gateway with the needed capabilities, e. g. CCDs, modem support, Internet connectivity is chosen.

All resources which have been reserved by a server have to be released by that server. For simplifying the message flows, described below relative to the Figures, the release of media gateway resources is omitted.

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In the examples, a one-to-one relation is assumed between the first control node GMSC/TSC server inside the core network and the first media gateway inside the CN.

To be able to receive incoming calls over different MGWs, but with the control signaling (IAM) to the same GMSC, the GMSC needs to have one point code per MGW, where the ISDN user plane can terminate. Out of the DPC, to which the IAM was sent, the GMSC can derive the media gateway to which the ISDN user plane was set up.

To allow that a TSC controls more than one media gateway for outgoing (incoming) traffic the TSC needs one point code per controlled media gateway. For a chosen media gateway the TSC has to use a certain OPC. Depending on the chosen OPC the transit switch can distinguish the ISDN user planes received from different MGWs.

Another alternative solution to receive or send user plane to different MGWs is that different signaling routes are used between servers, if the user plane is routed via different MGWs.

A third alternative to receive or send user plane to different MGWs from/to a transit switch and control signaling from/to one server is that different CICs are used for different MGWs, if the user plane is routed via different MGWs.

The concept of identifying the originating media gateway by OPC used in the IAM message instead of transporting the media gateway address in the IAM message, is also possible through the whole CN, but it requires, for a network of m MGWs, m different point codes in each of the the control servers, which can control the MGWs.

Another alternative solution to transfer the knowledge of an media gateway from one server to the other is to use different routes for signaling, if the user plane was routed to different MGWs. If a TSC can receive calls from m MGWs, then m different signaling routes towards the RNC are required.

In the following description of the various drawings, various signal names are used. Some of these signals are conventional in nature. The DTAP messages are defined in GSM 04.08 V8.0.0 and UMTS 24.08 V3.0.0. The RANAP messages are defined in UMTS 25.413 V1.0.2. The MAP messages are defined in GSM 09.02 V 6.3.0 and UMTS 29.002 V 3.3.2. The AAL2 messages are used for bearer control in accordance with the invention. The DCP messages, which are particularly described below, are used for communications between control nodes and the MGWs in connection with resource requests and assignments. The ISDN messages are used for signaling between network control nodes and external ISDN networks. An updated ISDN set of messages is to be used between core network servers. Updated is, for example, the IAM message.

Figure 1 shows a call from one UE to another UE within the network, with an media gateway address being transported in a forward direction. In this alternative the originating exchange selects the media gateway MGW1, e. g. on traffic and because of location, and transports the media gateway MGW1 address in the forward direction with the ISUP IAM message to the gateway mobile services switching centre GMSC1 and then to the mobile services switching centre MSC2.

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In this case only one media gateway is used, which can be used by all control servers to influence the user plane.

A transcoder is linked in by the originating MSC as the termination is not known. On the radio network controller RNC1 side, the coding negotiated with the user equipment UE1 is used and on the outgoing side a default coding is used. The terminating mobile services switching centre mobile services switching centre MSC2 chooses the default coding on the one side and the coding, which it negotiated with the user equipment UE2 on the side of the radio network controller RNC2. The following steps in the basic call setup, as with the other examples, below, describe the control signaling in each step and are numbered corresponding to reference numbers in the described figure. The description includes signal protocol, followed by the type of signal.

1.   DTAP, CM service request

2.   DTAP, Set-up

3.   DTAP, Call Proceeding

4.   DCP, resource request (MGW1)

5.   DCP, resource response (Pi1, Pv11)

6.   DCP, Through connect (Pv11, Pi1)

      The mobile services switching centre MSC1 commands the media gateway MGW1 to backward through connect the incoming point Pi1 and the virtual point Pv11.

7.   RANAP, Assignment Request

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8.   AAL2, Establish Request

9.   AAL2, Establish Confirm

10.   RANAP, Assignment Response

11.   ISDN, Initial Address Message IAM (MGW1, Pv11, OPC, DPC, CIC)

      Call set-up is requested from the originating mobile services switching centre MSC1.

      The media gateway MGW1 address and Pv11 or optional the OPC, DPC, CIC can

      be used for identifying the incoming connection in the gateway mobile services

      switching centre GMSC1.

12.   DCP, resource request (MGW1, Pv11)

13.   DCP, resource response (Pv12)

      A virtual point Pv12 is returned from the media gateway MGW1.

14.   Optional DCP, Through connect (Pv12, Pv11)

      The gateway mobile services switching centre GMSC1 commands the media gateway

      MGW1 to through connect the incoming point Pv12 and the virtual point Pv11.

      Optionally the whole media gateway MGW1 connection can be through connected

      with one DCP, Through connect (Pi1, Po1) message.

15.   MAP, SendRouting information request

      The gateway mobile services switching centre GMSC1 interrogates the home

location register HLR for routing information.

16.   MAP, SendRouting information response

The gateway mobile services switching centre GMSC1 receives the forwarding to

number and an indication, if a notification shall be given to the calling party.

17.   Optional ISDN, Address Complete Message ACM

The ACM message is sent from the gateway mobile services switching centre

GMSC1 to the mobile services switching centre MSC1.

18.   ISDN, Initial Address Message IAM (MGW1, Pv12, OPC, DPC, CIC)

The IAM message is sent from the gateway mobile services switching centre GMSC1

to the mobile services switching centre mobile services switching centre MSC2. The

media gateway MGW1 address and Pv12 or optional the OPC, DPC, CIC can be

used for identifying the incoming connection in the mobile services switching centre

mobile services switching centre MSC2.

19.   DCP, resource request (MGW1, Pv12)

Resources are requested for the call identified by its CIC.

20.   DCP, resource response (Po1)

An outgoing point Po1 is returned from the media gateway MGW1.

21.   DCP, Through connect (Po1, Pv12)

The mobile services switching centre mobile services switching centre MSC2

commands the media gateway MGW1 to through connect the virtual point Pv12 and

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the outgoing point Po1. Optionally, the media gateway MGW1 connection can be

through connected with one DCP, through connect (Pv11, Po1) message.

22.   RANAP, Paging

23.   DTAP, Paging Response

24.   DTAP, Set-up

25.   DTAP, Call confirmed

26.   RANAP, Assignment Request

27.   AAL2, Establish Request

28.   AAL2, Establish confirm

29.   RANAP, Assignment Response

30.   DTAP, Alert

31.   ISDN, Address Complete Message ACM

32.   ISDN, Call Proceeding CPG

33.   DTAP, Connect

34.   DTAP, Connect ack

35.   ISUP, Answer Message ANM

36.   ISUP, Answer Message ANM

37.   DCP, Through connect (Pv11, Pi1)

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The mobile services switching centre MSC1 commands the media gateway MGW1 to through connect the incoming point Pi1 and the virtual point Pv11.

38.   DTAP, Connect

39.   DTAP, Connect ACK.

Figure 2 illustrates a call to UE originating outside of the network. The media gateway address is again transported in the forward direction. Here a subscriber is calling a served user equipment UE1. In this case only one media gateway is used, which can be used by all control servers to influence the user plane.

A transcoder is linked in by the terminating mobile services switching centre MSC. On the incoming side, e. g. PCM coding is used and on the outgoing side the coding, negotiated with the user equipment UE1 by the radio network controller RNC, is used.

1.   ISDN, Initial Address Message IAM (OPC, DPC, CIC)

Call set-up is requested from an external ISDN network for a mobile terminated call attempt. In this example the gateway mobile services switching centre/transit switching centre GMSC1/TSC and the Signaling Gateway 1 are collocated.

2.   DCP, resource request (MGW1, CIC)

Resources are requested for the call identified by its CIC, which were chosen by the transit switch of the ISDN network.

3.   DCP, resource response (Pi1, Pv11)

An incoming point Pi1 and a virtual point Pv11 are returned from the media gateway MGW1.

4.   MAP, SendRouting Information request

The gateway mobile services switching centre GMSC1 interrogates the home location register HLR for routing information.

5.   MAP, SendRouting Information response

The gateway mobile services switching centre GMSC1 receives the mobile services switching centre MSC address.

6.   ISDN, Address Complete Message ACM

The ACM message is sent from the gateway mobile services switching centre/transit switching centre GMSC1/TSC to the transit switch 1.

7.   Optional DCP, Through connect (Pi1, Pv11)

The gateway mobile services switching centre/transit switching centre GMSC1/TSC commands the media gateway MGW1 to through connect the incoming point Pi1 and the virtual point Pv11. Optionally, the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi1, Po1) message.

8.   ISDN, Initial Address Message IAM (MGW1, Pv11, OPC, DPC, CIC)

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The IAM message is sent from the gateway mobile services switching centre/transit switching centre GMSC1/TSC to the mobile services switching centre MSC. The media gateway MGW1 address and Pv11 or optional the OPC, DPC, CIC can be used for identifying the incoming connection in the mobile services switching centre MSC.

9. DCP, resource request (MGW1, Pv11)

Resources are requested for the call identified by its CIC.

10. DCP, resource response (Po1)

An outgoing point Po1 is returned from the media gateway MGW1.

11. DCP, Through connect (Pv11, Po1)

The mobile services switching centre MSC commands the media gateway MGW1 to through connect the virtual point Pv11 and the outgoing point Po1. Optionally, the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi1, Po1) message.

12. RANAP, Paging

13. DTAP, Paging Response

14. DTAP, Set-up

15. DTAP, Call confirmed

16. RANAP, Assignment Request

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17.   AAL2, Establish Request

18.   AAL2, Establish confirm

19.   RANAP, Assignment Response

20.   DTAP, Alert

21.   ISDN, Address Complete Message ACM

22.   ISDN, Call Proceeding CPG

23.   DTAP, Connect

24.   DTAP, Connect ack

25.   ISUP, Answer Message ANM

26.   ISUP, Answer Message ANM

Figure 3 shows a call forwarding in a GMSC to an ISDN subscriber identified by an ISDN no. outside of the network. The media gateway address is transported in the forward direction.

For CFNREA in mobile services switching centre MSC the same handling applies as for CFNREA in GMSC. Therefore only the signaling for CFNREA in GMSC are described below.

Alternatively of transit switching centre TSC2 controlling the set-up from media gateway MGW1 to media gateway MGW2, GMSC can control the set-up as the analyse performed

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in GMSC optional to transit switching centre TSC2 can also deliver the media gateway MGW2 address as a one-to-one relation exists between both.

In this case only two MGWs are used, each at the edge of the network.

A transcoder is optionally linked in by the transit switching centre TSC2 in both media gateways, media gateway MGW1 and media gateway MGW2 to compress the transferred user data. On the STM side, e. g. PCM coding is used and on the other side CN default coding is used.

1.   ISDN, Initial Address Message IAM (OPC, CPC, CIC)

      Call set-up is requested from an external ISDN network for a mobile terminated call

      attempt. In this example the GMSC and the Signaling Gateway 1 are collocated.

2.   DCP, resource request (MGW1, CIC)

      Resources are requested for the call identified by its CIC, which were chosen by the

      transit switch 1 of the ISDN network.

3.   DCP, resource response (Pi1, Pv11)

      An incoming point Pi1 and a virtual point Pv11 are returned from the media gateway

MGW1.

4.   MAP, SendRouting Information request

      The GMSC interrogates the home location register HLR for routing information.

5.   MAP, SendRouting Information response

The GMSC receives the forwarding to number and an indication, if a notification shall be given to the calling party. The forwarded-to number received fromhome location register HLR is analysed and a transit switching centre TSC2 and optional media gateway MGW2 address are received from the B-number analysis.

6.   ISDN, Address Complete Message ACM

The ACM message is sent from the GMSC to the transit switch 1. An outband notification can be included in the AM message. This saves signaling, in and out linking of announcement machine and user plane transmission.

7.   Optional DCP, Connect announcement machine (Pi1)

Optional the announcement machine is connected, if inband notification is required.

8.   Optional DCP, Disconnect announcement machine (Pi1)

After the announcement the announcement machine is disconnected.

9.   Optional DCP, Through connect (Pi1, Pv11)

The GMSC commands the media gateway MGW1 to through connect the incoming point Pi1 and the virtual point Pv11. Optionally, the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi1, Po1) message. This is in line with ITU N-ISDN specifications.

10.   ISDN, Initial Address Message IAM (MGW1, PV11, OPC, DPC, CIC)

The IAM message is sent from the GMSC to the transit switching centre TSC2, which is controlling the media gateway MGW2. The media gateway MGW1 address and PV11 or optional the OPC, DPC, CIC can be used for identifying the incoming connection in the transit switching centre TSC2.

11.   DCP, resource request (MGW2)

Resources are requested for the call identified by its CIC.

12.   DCP, resource response (Pi2, Pv21)

An incoming point Pi2 and a virtual point Pv21 are returned from the media gateway MGW2.

13.   DCP, Set-up connection (MGW1, MGW2, Pv11, Pi2)

The transit switching centre TSC2 requests resources for an outgoing call identified by its virtual CIC and commands the media gateway MGW1 to set up a connection towards Pi2 in media gateway MGW2.

14.   AAL2, Establish Request

15.   AAL2, Establish confirm

16.   DCP, Set-up connection response (Po1)

The media gateway MGW1 signals back that the outgoing connection has been set up successfully and returns an outgoing point Po1.

17.   DCP, Through connect (Po1, Pv11)

The transit switching centre TSC2 commands the media gateway MGW1 to through connect the outgoing point Po1 and the virtual point Pv11. Optionally, the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi1, Po1) message.

18.   Optional DCP, Through connect (Po1, Pv2)

The transit switching centre TSC2 commands the media gateway MGW2 to through connect the incoming point Pi2 and the virtual point Pv21.

19.   DCP, Set-up connection (MGW2, Pv21)

The transit switching centre TSC2 requests resources for an outgoing call identified by its virtual CIC and commands the media gateway MGW2 to set up a connection toward the transit switch 2.

20.   DCP, Set-up connection response (Po2, CIC)

The media gateway MGW2 signals back that the outgoing connection has been set up successfully and returns an outgoing point Po2.

21.   DCP, Through connect (Po2, Pv21)

The transit switching centre TSC2 commands the media gateway MGW2 to through connect the outgoing point Po2 and the virtual point Pv21.

22.   ISDN, Initial Address Message IAM (OPC, DPC, CIC)

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The IAM message is sent from the transit switching centre TSC2 to the transit switch

2.

23.   ISDN, Address Complete Message ACM

24.   ISDN, Call Proceeding CPG

25.   ISDN, Call Proceeding CPG

26.   ISDN, Answer Message ANM

27.   ISDN, Answer Message ANM

       The ANM message is passed on by the transit switching centre TSC2.

28.   ISDN, Answer ANM

       The ANM message is passed on by the GMSC.

Figure 4 illustrates call forwarding in GMSC to a UE subscriber identified by a UE

no. in the network. The media gateway address is transported in the forward direction.

For subsequent forwarding to UE in GMSC instead of gateway mobile services

switching centre GMSC2 several GMSCs have to be included. In this case only one media gateway

is used, which can be used by all control servers to influence the user plane. A transcoder is linked

in by the terminating mobile services switching centre MSC. On the incoming side, e. g. PCM

coding is used and on the outgoing side the coding, negotiated with the user equipment UE1, is used.

1.   ISDN, Initial Address Message IAM (OPC, DPC, CIC)

Call set-up is requested from an external ISDN network for a mobile terminated call

attempt. In this example the gateway mobile services switching centre/transit

switching centre GMSC1/TSC1 and the Signaling Gateway 1 are collocated.

2.   DCP, resource request (MGW1, CIC)

Resources are requested for the call identified by its CIC, which were chosen by the

transit switch of the ISDN network.

3.   DCP, resource response (Pi1, Pv11)

An incoming point Pi1 and a virtual point Pv11 are returned from the media gateway

MGW1.

4.   MAP, SendRouting Information request

The GSMC interrogates the home location register HLR for routing information.

5.   MAP, SendRouting Information response

The gateway mobile services switching centre GMSC1 receives the forwarding to

number and an indication, if a notification shall be given to the calling party.

6.   ISDN, Address Complete Message ACM

The ACM message is sent from the gateway mobile services switching centre/transit

switching centre GMSC1/TSC1 to the transit switch 1. An outband notification can

be included in the ACM message. This saves signaling, in and out linking of

announcement machine and user plane transmission.

7.   Optional DCP, Connect announcement machine (Pi2)

Optionally the announcement machine is connected, if inband notification is required.

8.   Optional DCP, Disconnect announcement machine (Pi1)

After the announcement the announcement machine is disconnected.

9.   Optional DCP, Through connect (Pi1, Pv11)

The gateway mobile services switching centre/transit switching centre GMSC1/TSC1 commands the media gateway MGW1 to through connect the incoming point Pi1 and the virtual point Pv11. Optionally, the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi1, Po1) message.

10.   ISDN, Initial Address Message IAM (MGW1, PV11, OPC, DPC, CIC)

The IAM message is sent from the gateway mobile services switching centre/transit switching centre GMSC1/TSC1 to the gateway mobile services switching centre GMSC2. The media gateway MGW1 address and Pv11 or optional the OPC, DPC, CIC can be used for identifying the incoming connection in the gateway mobile services switching centre GMSC2.

11.   DCP, resource request (MGW1, Pv11)

Resources are requested for the call identified by its CIC.

12.   DCP, resource response (Pv12)

A virtual point Pv12 is returned from the media gateway MGW1.

13.   Optional DCP, Through connect (Pv11, Pv12)

The gateway mobile services switching centre GMSC2 commands the media gateway MGW1 to through connect the virtual point Pv11 and the virtual point Pv12. Optionally, the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi1, Po1) message.

14.   MAP, SendRouting Information request

The gateway mobile services switching centre GMSC2 receives the mobile services switching centre MSC address from HLR.

15.   MAP, SendRouting Information request

The gateway mobile services switching centre GMSC2 receives the mobile services switching centre MSC address from HLR.

16.   ISDN, Initial Address Message IAM (MGW1, PV12, OPC, DPC, CIC)

The IAM message is sent from the gateway mobile services switching centre GMSC2 to the mobile services switching centre MSC.

17.   DCP, resource request (MGW1, Pv12)

Resources are requested for the call identified by its CIC.

18.   DCP, resource response (Po1)

An outgoing point Po1 is returned from the media gateway MGW1.

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19. DCP, Through connect (Po1, Pv12)

The mobile services switching centre MSC commands the media gateway MGW1

to through connect the virtual point Pv12 and the outgoing point Po1. Optionally, the

whole media gateway MGW1 connection can be through connected with one DCP,

Through connect (Pi1, Po1) message.

20. RANAP, Paging

21. DTAP, Paging Response

22. DTAP, Set-up

23. DTAP, Call confirmed

24. RANAP, Assignment Request

25. AAL2, Establish Request

26. AAL2, Establish confirm

27. RANAP, Assignment Response

28. DTAP, Alert

29. ISDN, Address Complete Message ACM

30. ISDN, Call Proceeding CPG

31. ISDN, Call Proceeding CPG

32. DTAP, Connect

33. DTAP, Connect ack

30

34.   ISUP, Answer Message ANM

35.   ISUP, Answer Message ANM

36.   ISUP, Answer Message ANM

Figure 5 illustrates a call from UE with Call forwarding in GMSC to a UE subscriber identified by a UE no. in the network. The media gateway address is transported in the forward direction.

There are three alternatives for assuring user plane optimised routing. In the first alternative the media gateway MGW1 is chosen in the mobile services switching centre mobile services switching centre MSC2. Then the media gateway MGW1 address is transferred in the backward direction with ISUP ACM/CPG or some new message to the originating mobile services switching centre MSC1. The mobile services switching centre MSC1 then commands radio network controller RNC1 to set-up the user plane connection towards media gateway MGW1 and commands media gateway MGW1 to through connect. Then mobile services switching centre mobile services switching centre MSC2 commands radio network controller RNC2 to set up the user plane connection towards media gateway MGW1.

The second alternative commands the radio network controllers to connect without in linking of an media gateway and only possible for the mobile to mobile case.

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The third alternative is that the originating exchange selects the media gateway MGW1 and transports the media gateway MGW1 address in the forward direction with the ISUP IAM message to the mobile services switching centre mobile services switching centre MSC2. This alternative can be optimised by combining it with the first alternative. So if a media gateway address is received in the backward direction, then the mobile services switching centre MSC1 can perform a subsequent assignment towards radio network controller RNC1. Below the third alternative without optimisation is described.

For subsequent forwarding to UE in GMSC instead of gateway mobile services switching centre GMSC2 several GMSCs have to be included. In this case only one media gateway is used, which can be used only by all control servers to influence the user plane. A transcoder is linked in by the originating MSC as the termination is not known. On the radio network controller RNC1 side, the coding is negotiated with the user equipment UE1 is used and on the outgoing side a default coding is used. The terminating mobile services switching centre mobile services switching centre MSC2 chooses the default coding on the one side and the coding, which it negotiated with the user equipment UE2 on the side of radio network controller RNC2. If only media gateway is used that comprises both linked in CODECs, the media gateway can decide to link out both CODECs if the coding towards user equipment UE1 and user equipment UE2 is of the same type.

1.   DTAP, CM service request

2.   DTAP, Set-up

3.   DTAP, Call Proceeding

4.   DCP, resource request (MGW1)

5.   DCP, resource response (Pi1, Pv11)

An incoming point Pi1 and a virtual point Pv11 are returned from the media gateway

MGW1.

6.   DCP, Through connect (Pv11, Pi1)

The mobile services switching centre MSC1 commands the media gateway MGW1

to backward through connect the incoming point Pi1 and the virtual point Pv11.

7.   RANAP, Assignment Request

8.   AAL2, Establish Request

9.   AAL2, Establish Confirm

10.   RANAP, Assignment Response

11.   ISDN, Initial Address Message IAM (MGW1, Pv11, OPC, DPC, CIC)

Call set-up is requested from the originating mobile services switching centre MSC1.

The media gateway MGW1 address and Pv11 or optionally the OPC, DPC, CIC can

be used for identifying the incoming connection in the gateway mobile services

switching centre/transit switching centre GMSC1/TSC.

12.   DCP, resource request (MGW1, Pv11)

13.   DCP, resource response (Pv12)

A virtual point Pv12 is returned from the media gateway MGW1.

14.   Optional DCP, Through connect (Pv12, Pv11)

The gateway mobile services switching centre GMSC1 commands the media gateway

MGW1 to through connect the incoming point Pv12 and the virtual point Pv11.

Optionally, the whole media gateway MGW1 connection can be through connected

with one DCP, Through connect (Pi1, Po1) message.

15.   MAP, SendRouting Information request

The gateway mobile services switching centre GMSC1 interrogates the home

location register HLR for routing information.

16.   MAP, SendRouting Information response

The gateway mobile services switching centre GMSC1 receives the forwarding to

number and an indication, if a notification shall be given to the calling party.

17,   Optional ISDN, Address Complete Message ACM

The ACM message is send from the gateway mobile services switching centre

GMSC1 to the MSC.

18.   ISDN, Initial Address Message IAM (MGW1, Pv12, OPC, DPC, CIC)

The IAM message is send from the gateway mobile services switching centre

GMSC1 to the gateway mobile services switching centre GMSC2. The media

gateway MGW1 address and Pv12 or optionally the OPC, DPC, CIC can be used for

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identifying the incoming connection in the gateway mobile services switching centre GMSC2.

19.   DCP, resource request (MGW1, Pv12)

Resources are requested for the call identified by its CIC.

20.   DCP, resource response (Pv13)

A virtual point Pv13 is returned from the media gateway MGW1.

21.   Optional DCP, Through connect (Pv13, Pv12)

The gateway mobile services switching centre GMSC2 commands the media gateway MGW1 to through connect the virtual point Pv13 and the virtual point Pv12. Optionally, the media gateway MGW1 connection can be through connected with one DCP, Through connect (Pv11, Po1) message.

22.   MAP, SendRouting Information request

The gateway mobile services switching centre GMSC2 interrogates the home location register HLR for routing information.

23.   MAP, SendRouting Information response

The gateway mobile services switching centre GMSC2 receives the MSC address from HLR.

24.   ISDN, Initial Address Message IAM (MGW1, Pv13, OPC, DPC, CIC)

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The IAM message is sent from the gateway mobile services switching centre GMSC2 to the MSC.

25.   DCP, resource request (MGW1, Pv13)

      Resources are requested for the call identified by its CIC.

26.   DCP, resource response (Po1)

      An outgoing point Po1 is returned from the media gateway MGW1.

27.   DCP, Through connect (Po1, Pv13)

      The mobile services switching centre mobile services switching centre MSC2 commands the media gateway MGW1 to through connect the virtual point Pv13 and the outgoing point Po1. Optionally, the media gateway MGW1 connection can be through connected with one DCP, Through connect (Pv11, Po1) message.

28.   RANAP, Paging

29.   DTAP, Paging Response

30.   DTAP, Set-up

31.   DTAP, Call confirmed

32.   RANAP, Assignment Request

33.   AAL2, Establish Request

34.   AAL2, Establish confirm

35.   RANAP, Assignment Response

36

36.   DTAP, Alert

37.   ISDN, Address Complete Message ACM

38.   ISDN, Call Proceeding CPG

39.   ISDN, Call Proceeding CPG

40.   ISDN, Call Proceeding CPG

41.   DTAP, Connect

42.   DTAP, Connect ack

43.   ISUP, Address Complete Message ANM

44.   ISUP, Address Complete Message ANM

45.   ISUP, Address Complete Message ANM

46.   DCP, Through connect (Pv11, Pi1)

       The mobile services switching centre MSC1 commands the media gateway MGW1

       to through connect the incoming point Pi1 and the virtual point Pv11.

47.   DTAP, Connect

48.   DTAP, Connect ACK

Figure 6 illustrates call forwarding in mobile services switching centre MSC to an

ISDN subscriber identified by an ISDN no. The media gateway address is transported in the forward

direction.

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In this example the conditional call forwarding in mobile services switching centre MSC is described. The case describes CFNRY, if the UE user does not answer the call, and the call has to be forwarded to an ISDN no. In case of CFNREA, if the UE does not answer the paging, steps 12 to 22 are to be omitted. In the current example only two MGWs are used, each at the edge of the network. A transcoder is optionally linked in by the TSC in both media gateways to compress the transferred user data. On the STM side, e. g., PCM coding is used and on the other side CN default coding is used.

1.   ISDN, Initial Address Message IAM (OPC, DPC, CIC)

        Call set-up is requested from an external ISDN network for a mobile terminated call

        attempt. In this example the gateway mobile services switching centre/transit

        switching centre GMSC1/TSC1 and the Signaling Gateway 1 are collocated.

2.   DCP, resource request (MGW1, CIC)

        Resources are requested for the call identified by its CIC, which were chosen by the

        transit switch of the ISDN network.

3.   DCP, resource response (Pi1, Pv11)

        An incoming point Pi1 and a virtual point Pv11 are returned from the media gateway

MGW1.

4.   MAP, SendRouting Information request

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The gateway mobile services switching centre GMSC1 interrogates the home location register HLR for routing information.

5.   MAP, SendRouting Information response

The gateway mobile services switching centre GMSC1 receives the mobile services switching centre MSC address.

6.   ISDN, Address Complete Message ACM

The ACM message is sent from the GMSC to the transit switch 1.

7.   Optional DCP, Through connect (Pi1, Pv11)

The GMSC commands the media gateway MGW1 to through connect the incoming point Pi1 and the virtual point Pv11. Optionally, the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi1, Po1) message.

8.   ISDN, Initial Address Message IAM (MGW1, Pv11, OPC, DPC, CIC)

The IAM message is sent from the GMSC to the mobile services switching centre MSC. The media gateway MGW1 address and Pv11 or optional the OPC, DPC, CIC can be used for identifying the incoming connection in the mobile services switching centre MSC.

9.   DCP, resource request (MGW1, Pv11)

Resources are requested for the call identified by its CIC.

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10.   DCP, resource response (Pol)

       An outgoing point Pol is returned from the media gateway MGW1.

11.   DCP, Through connect (Pv11, Pol)

       The mobile services switching centre MSC commands the media gateway MGW1

       to through connect the virtual point Pv11 and the outgoing point Pol. Optionally the

       whole media gateway MGW1 connection can be through connected with one DCP,

       Through connect (Pi1, Pol) message.

12.   RANAP, Paging

13.   DTAP, Paging Response

14.   DTAP, Set-up

15.   DTAP, Call confirmed

16.   RANAP, Assignment Request

17.   AAL2, Establish Request

18.   AAL2, Establish confirm

19.   RANAP, Assignment Response

20.   DTAP, Alert

21.   ISDN, Address Complete Message ACM

22.   ISDN, Call Proceeding CPG

23.   RANAP, Iu release command

24.   AAL2, Release request

25.   AAL2, Release confirm

26.   RANAP, Iu release complete

27.   Optional DCP, Connect announcement machine (Pv11)

Optionally, the announcement machine is connected, if inband notification is required.

28.   Optional DCP, Disconnect announcement machine (Pv11)

After the announcement the announcement machine is disconnected.

29.   ISDN, Initial Address Message IAM (MGW1, Po1, OPC, DPC, CIC)

The IAM message is send from the mobile services switching centre MSC to the transit switching centre TSC2. The media gateway MGW1 address and Pv11 or optionally the OPC, DPC, CIC can be used for identifying the incoming connection in the mobile services switching centre MSC.

30.   DCP, resource request (MGW2)

Resources are requested for the call identified by its CIC.

31.   DCP, resource response (Pi2, Pv21)

An incoming point Pi2 and a virtual point Pv21 are returned from the media gateway MGW2.

32.   DCP, Set-up connection (MGW1, media gateway MGW2, Po1, Pi2)

The transit switching centre TSC2 requests the already reserved resources for an

outgoing call identified by its virtual CIC and commands the media gateway MGW1

to set up a connection towards Pi2 in media gateway MGW2.

33.   AAL2, Establish Request

34.   AAL2, Establish confirm

35.   DCP, Set-up connection response (Po1)

       The media gateway MGW1 signals back that the outgoing connection has been set

       up successful and returns an outgoing point Po1.

36.   DCP, Through connect (Po1, Pv11)

       The transit switching centre TSC2 commands the media gateway MGW1 to through

       connect the outgoing point Po1 and the virtual point Pv11. If optional DCP, Through

       connect (Pi2, Pv11) is omitted, instead of Pv11 Pi1 must be used.

37.   Optional DCP, Through connect (Pi2, Pv21)

       The transit switching centre TSC2 commands the media gateway MGW2 to through

       connect the incoming point Pi2 and the virtual point Pv21.

38.   DCP, Set-up connection (MGW2, Pv21)

       The transit switching centre TSC2 requests resources for an outgoing call identified

       by its virtual CIC and commands the media gateway MGW2 to set up a connection

       towards the transit switch 2.

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39.   DCP, Set-up connection response (Po2, CIC)

The media gateway MGW2 signals back that the outgoing connection has been set

up successfully and returns an outgoing point Po2.

40.   DCP, Through connection (Po2, Pv21)

The transit switching centre TSC2 commands the media gateway MGW2 to through

connect the outgoing point Po2 and the virtual point Pv21.

41.   ISDN, Initial Address Message IAM (OPC, DPC, CIC)

The IAM message is send from the transit switching centre TSC2 to the transit switch

2.

42.   ISDN, Address Complete Message ACM

43.   ISDN, Call Proceeding CPG

44.   ISDN, Call Proceeding CPG

45.   ISDN, Call Proceeding CPG

46.   ISDN, Answer Message ANM

47.   ISDN, Answer Message ANM

48.   ISDN, Answer Message ANM

49.   ISDN, Answer Message ANM

Figure 7 illustrates call waiting and accepting the waiting call in different MGWs.

The media gateway address is transported in the forward direction.

Here a subscriber B is calling a served user equipment A, who has the supplementary

services CW and HOLD. After the call from B to A is active another terminating call from a

subscriber C to A is received. Subscriber A accepts the waiting call from C and therefore has to put

the call to B on hold. The user plane is routed directly to the media gateway of the active call. This

is the optimal way for the transmission, but it requires subsequent assignment over the Iu interface.

In this case only one media gateway is used for each call, which can be used by all

control servers to influence the user plane. No user plane connection is needed between the MGWs.

1.   ISDN, Initial Address Message IAM (OPC, DPC, CIC)

         Call set-up is requested from an external ISDN network for a mobile terminated call

         attempt. In this example the gateway mobile services switching centre/transit

         switching centre GMSC1/TSC and the Signaling Gateway 1 are collocated.

2.   DCP, resource request (MGW1, CIC)

         Resources are requested for the call identified by its CIC, which were chosen by the

         transit switch of the ISDN network.

3.   DCP, resource response (Pi1, Pv11)

         An incoming point Pi1 and a virtual point Pv11 are returned from the media gateway

MGW1.

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4.   MAP, SendRouting Information request

The gateway mobile services switching centre GMSC1 interrogates the home location register HLR for routing information.

5.   MAP, SendRouting Information response

The gateway mobile services switching centre GMSC1 receives the mobile services switching centre MSC address.

6.   ISDN, Address Complete Message ACM

The ACM message is sent from the gateway mobile services switching centre/transit switching centre GMSC1/TSC to the transit switch 1.

7.   Optional DCP, Through connect (Pi1, Pv11)

The gateway mobile services switching centre/transit switching centre GMSC1/TSC commands the media gateway MGW1 to through connect the incoming point Pi1 and the virtual point Pv11. Optionally, the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi1, Po1) message.

8.   ISDN, Initial Address Message IAM (MGW1, Pv11, OPC, DPC, CIC)

The IAM message is sent from the gateway mobile services switching centre/transit switching centre GMSC1/TSC to the mobile services switching centre MSC. The media gateway MGW1 address and Pv11 or optionally the OPC, DPC, CIC can be

used for identifying the incoming connection in the mobile services switching centre MSC.

9.   DCP, resource request (MGW1, Pv11)

Resources are requested for the call identified by its CIC.

10.   DCP, resource response (Po1)

An outgoing point Po1 is returned from the media gateway MGW1.

11.   DCP, Through connect (Pv11, Po1)

The mobile services switching centre MSC commands the media gateway MGW1 to through connect the virtual point Pv11 and the outgoing point Po1. Optionally the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi1, Po1) message.

12.   RANAP, Paging

13.   DTAP, Paging Response

14.   DTAP, Set-up

15.   DTAP, Call confirmed

16.   RANAP, Assignment Request

17.   AAL2, Establish Request

18.   AAL2, Establish confirm

19.   RANAP, Assignment Response

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20. DTAP, Alert

21. ISDN, Address Complete Message ACM

22. ISDN, Call Proceeding CPG

23. DTAP, Connect

24. DTAP, Connect ack

25. ISUP, Answer Message ANM

26. ISUP, Answer Message ANM

27. ISDN, Initial Address Message IAM (OPC, DPC, CIC)

Call set-up is requested from an external ISDN network for a mobile terminated call

attempt. In this example the gateway mobile services switching centre GMSC2 and

the Signaling Gateway 2 are collocated.

28. DCP, resource request (MGW2, CIC)

Resources are requested for the call identified by its CIC, which were chosen by the

transit switch 2 of the ISDN network.

29. DCP, resource response (Pi2, Pv11)

An incoming point Pi2 and a virtual point Pv21 are returned from the media gateway

MGW2.

30. MAP, SendRouting Information request

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The gateway mobile services switching centre GMSC2 interrogates the home location register HLR for routing information.

31.   MAP, SendRouting Information response

The gateway mobile services switching centre GMSC2 receives the mobile services switching centre MSC address.

32.   ISDN, Address Complete Message ACM

The ACM message is send from the gateway mobile services switching centre GMSC2 to the transit switch 2.

33.   Optional DCP, Through connect (Pi2, Pv21)

The gateway mobile services switching centre GMSC2 commands the media gateway MGW2 to through connect the incoming point Pi2 and the virtual point Pv21. Optionally, the whole media gateway MGW2 connection can be through connected with one DCP, Through connect (Pi2, Po2) message.

34.   ISDN, Initial Address Message IAM (MGW2, Pv21, OPC, DPC, CIC)

The IAM message is sent from the gateway mobile services switching centre GMSC2 to the mobile services switching centre MSC. The media gateway MGW2 address and Pv21 or optionally the OPC, DPC, CIC can be used for identifying the incoming connection in the mobile services switching centre MSC.

35.   DCP, resource request (MGW2, Pv21)

Resources are requested for the call identified by its CIC.

36.   DCP, resource response (Po2)

An outgoing point Po2 is returned from the media gateway MGW2.

37.   DCP, Through connect (Pv21, Po1)

The mobile services switching centre MSC commands the media gateway MGW2

to through connect the virtual point Pv21 and the outgoing point Po2. Optionally, the

whole media gateway MGW2 connection can be through connected with one DCP,

Through connect (Pi2, Po2) message.

38.   RANAP, Paging

39.   DTAP, Paging Response

40.   DTAP, Set-up

41.   DTAP, Call confirmed

42.   DTAP, Alert

43.   ISDN, Address Complete Message ACM

44.   ISDN, Call Proceeding CPG

45.   DTAP, HOLD (B)

46.   DTAP, HOLD ACK

47.   ISUP, Call Proceeding Message CPG (B held)

48.   ISUP, Call Proceeding Message CPG (B held)

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49.   RANAP, Assignment Request

50.   AAL2, Release Request

51.   AAL2, Release Confirm

52.   AAL2, Establish Request

53.   AAL2, Establish confirm

54.   RANAP, Assignment Response

55.   DTAP, Connect

56.   DTAP, Connect ack

57.   ISUP, Answer Message ANM

58.   ISUP, Answer Message ANM

Figure 8 illustrates call waiting and accepting the waiting call in one media gateway. The media gateway address is transported in the forward direction.

Here a subscriber B is calling a served mobile subscriber A, who has the supplementary services CW and HOLD. After the call from B to A is active another terminating call from a subscriber C over media gateway MGW2 to A is received. Subscriber A accepts the waiting call from C and therefore has to put the call to B on hold. The user plane is routed from media gateway MGW2 to the media gateway MGW1 of the first active call. The active call becomes then the held call. It is assumed that both the active and the waiting call use the same service, e. g.,

speech, so that the AAL2 connection between radio network controller RNC and media gateway MGW1 can be reused. This allows fast switches between the active and the held call and if a multiparty is required later on, only a conference call device has to be linked in the media gateway MGW1.

In this case only one media gateway is used for each call, which can be used by all control servers to influence the user plane. The user plane connections are gathered at one media gateway. This allows faster switches between the calls from B and C. A transcoder is linked in by the terminating mobile services switching centre MSC for each call. On the incoming side, e. g., PCM coding is used and on the outgoing side the coding, negotiated with the UEs, is used.

1. ISDN, Initial Address Message IAM (OPC, DPC, CIC)

    Call set-up is requested from an external ISDN network for a mobile terminal call attempt. In this example the gateway mobile services switching centre/transit switching centre GMSC1/TSC and the Signaling Gateway 1 are collocated.

2. DCP, resource request (MGW1, CIC)

    Resources are requested for the call identified by its CIC, which were chosen by the transit switch of the ISDN network.

3. DCP, resource response (Pi2, Pv11)

    An incoming point Pi1 and a virtual point Pv11 are returned from the media gateway MGW1.

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4.   MAP, SendRouting Information request

The gateway mobile services switching centre GMSC1 interrogates the home location register HLR for routing information.

5.   MAP, SendRouting Information response

The gateway mobile services switching centre GMSC1 receives the mobile services switching centre MSC address.

6.   ISDN, Address Complete Message ACM

The ACM message is send from the gateway mobile services switching centre/transit switching centre GMSC1/TSC to the transit switch 1.

7.   Optional DCP, Through connect (Pi1, Pv11)

The gateway mobile services switching centre/transit switching centre GMSC1/TSC commands the media gateway MGW1 to through connect the incoming point Pi1 and the virtual point Pv11. Optionally, the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi2, Po2) message.

8.   ISDN, Initial Address Message IAM (MGW1, Pv11, OPC, DPC, CIC)

The IAM message is sent from the gateway mobile services switching centre/transit switching centre GMSC1/TSC to the mobile services switching centre MSC. The media gateway MGW1 address and Pv11 or optional the OPC, DPC, CIC can be

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used for identifying the incoming connection in the mobile services switching centre

MSC.

9.   DCP, resource request (MGW1, Pv11)

Resources are requested for the call identified by its CIC.

10.   DCP, resource response (Po1)

An outgoing point Po1 is returned from the media gateway MGW1.

11.   DCP, Through connect (Pv11, Po1)

The mobile services switching centre MSC commands the media gateway MGW1

to through connect the virtual point Pv11 and the outgoing point Po1. Optionally, the

whole media gateway MGW1 connection can be through connected with one DCP,

Through connect (Pi1, Po1) message.

12.   RANAP, Paging

13.   DTAP, Paging Response

14.   DTAP, Set-up

15.   DTAP, Call confirmed

16.   RANAP, Assignment Request

17.   AAL2, Establish Request

18.   AAL2, Establish confirm

19.   RANAP, Assignment Response

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20.   DTAP, Alert

21.   ISDN, Address Complete Message ACM

22.   ISDN, Call Proceeding CPG

23.   DTAP, Connect

24.   DTAP, Connect ack

25.   ISUP, Answer Message ANM

26.   ISUP, Answer Message ANM

27.   ISDN, Initial Address Message IAM (OPC, DPC, CIC)

       Call set-up is requested from an external ISDN network for a mobile terminated call

       attempt. In this example the gateway mobile services switching centre GMSC2 and

       the Signaling Gateway 2 are collocated.

28.   DCP, resource request (MGW2, CIC)

       Resources are requested for the call identified by its CIC, which were chosen by the

       transit switch 2 of the ISDN network.

29.   DCP, resource response (Pi2, Pv11)

       An incoming point Pi2 and a virtual point Pv21 are returned from the media gateway

MGW2.

30.   MAP, SendRouting Information request

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The gateway mobile services switching centre GMSC2 interrogates the home location register HLR for routing information.

31.   MAP, SendRouting Information response

The gateway mobile services switching centre GMSC2 receives the mobile services switching centre MSC address.

32.   ISDN, Address complete Message ACM

The ACM message is send from the gateway mobile services switching centre GMSC2 to the transit switch 2.

33.   Optional DCP, Through connect (Pi2, Pv21)

The gateway mobile services switching centre GMSC2 commands the media gateway MGW2 to through connect the incoming point Pi2 and the virtual point Pv21. Optionally, the whole media gateway MGW2 connection can be through connected with one DCP, Through connect (Pi2, Po2) message.

34.   ISDN, Initial Address Message IAM (MGW2, Pv21, OPC, DPC, CIC)

The IAM message is sent from the gateway mobile services switching centre GMSC2 to the mobile services switching centre MSC. The media gateway MGW2 address and Pv21 or optionally the OPC, DPC, CIC can be used for identifying the incoming connection in the mobile services switching centre MSC.

35.   DCP, resource request (MGW1)

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Resources are requested for incoming AAL2 connection.

36.   DCP, resource response (Pv12, Pi11)

An incoming point Pi11 is returned from the media gateway MGW1.

37.   Optional DCP, Through connect (Pv12, Pi11)

The mobile services switching centre MSC commands the media gateway MGW1

to through connect the virtual point Pv12 and the incoming point Pi11. Optionally,

the whole media gateway MGW1 connection can be through connected with one

DCP, Through connect (Pi11, Po2) message.

38.   RANAP, Paging

39.   DTAP, Paging Response

40.   DTAP, Set-up

41.   DTAP, Call confirmed

42.   DTAP, Alert

43.   ISDN, Address Complete Message ACM

44.   ISDN, Call Proceeding CPG

45.   DTAP, HOLD (B)

46.   DTAP, HOLD ACK

47.   ISUP, Call Proceeding Message CPG (B held)

48.   ISUP, Call Proceeding Message CPG (B held)

49.   DCP, Set-up connection (MGW1, media gateway MGW2, Pv21, Pi11)

        MSC requests resources for an outgoing AAL2 connection and commands the media

        gateway MGW1 to set up a connection towards Pi11 in media gateway MGW1.

50.   AAL2, Establish Request

51.   AAL2, Establish confirm

52.   DCP, Set-up connection response (Po2)

        The media gateway MGW2 signals back that the outgoing connection has been set

        up and returns an outgoing point Po2.

53.   DCP, Through connect (Pv21, Po2)

        The mobile services switching centre MSC commands the media gateway MGW2

        to through connect the virtual point Pv21 and the outgoing point Po2. Optionally, the

        whole media gateway MGW2 connection can be through connected with one DCP,

        Through connect (Pi2, Po2) message.

54.   DCP, Disconnect (Po1, Pv11)

55.   DCP, Through connect (Pv12, Po2)

        The mobile services switching centre MSC commands the media gateway MGW1

        to through connect the virtual point Pv12 and the outgoing point Po2. Optionally, the

        whole media gateway MGW2 connection can be through connected with one DCP,

        Through connect (Pi2, Po2) message. This connects the existing user plane between

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radio network controller RNC and media gateway MGW1 with the user plane of

subscriber C.

56.   DTAP, Connect

57.   DTAP, Connect ack

58.   ISUP, Answer Message ANM

59.   ISUP, Answer Message ANM

Figure 9 illustrates a MPTY call. The media gateway address is transported in the

forward direction.

Here a subscriber B is calling a served user equipment A, who has the supplementary

services CW, HOLD and MPTY. After the call from B to A is active another terminating call from

a subscriber C over media gateway MGW2 to A is received. Subscriber A accepts the waiting call

from C and therefore has to put the call to B on hold. The user plane of the second call is routed from

media gateway MGW2 to the media gateway MGW1 of the first active call. Then mobile services

switching centre MSC commands media gateway MGW1 to switch from the former active call to

the waiting call. The active call becomes then the held call. It is assumed that both the active and the

waiting call use the same service, e. g., speech, so that the AAL2 connection between radio network

controller RNC and media gateway MGW1 can be reused. Now a multiparty is invoked by

subscriber A. Therefore the mobile services switching centre MSC links in a conference call device

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(CCD). Before the user planes can be connected, the user planes all must be in the same format, e.

g., PCM 64 kbit/s.

In this case only one media gateway is used for each call, which can be used by all

control servers to influence the user plane. The user plane connections are gathered at one media

gateway. This allows faster switches between the calls from B and C.

A transcoder is linked in by the terminating mobile services switching centre MSC

for each call. On the incoming side, e. g., PCM coding is used and on the outgoing side the coding,

negotiated with the UEs, is used. The linked in conference bridge is assumed to be a PCM

conference bridge, therefore at each leg coding from the received coding to PCM coding applies.

This allows gathering of different coded data streams.

1.   ISDN, Initial Address Message IAM (OPC, DPC, CIC)

        Call set-up is requested from an external ISDN network for a mobile terminated call

        attempt. In this example the gateway mobile services switching centre/transit

        switching centre GMSC1/TSC and the Signaling Gateway 1 are collocated.

2.   DCP, resource request (MGW1, CIC)

        Resources are requested for the call identified by its CIC, which were chosen by the

        transit switch of the ISDN network.

3.   DCP, resource response (Pi1, Pv11)

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An incoming point Pi1 and a virtual point Pv11 are returned from the media gateway MGW1.

4.   MAP, SendRouting Information request

The gateway mobile services switching centre GMSC1 interrogates the home location register HLR for routing information.

5.   MAP, SendRouting Information response

The gateway mobile services switching centre GMSC1 receives the mobile services switching centre MSC address.

6.   ISDN, Address Complete Message ACM

The ACM message is send from the gateway mobile services switching centre/transit switching centre GMSC1/TSC to the transit switch 1.

7.   Optional DCP, Through connect (Pi1, Pv11)

The gateway mobile services switching centre/transit switching centre GMSC1/TSC commands the media gateway MGW1 to through connect the incoming point Pi1 and the virtual point Pv11. Optionally, the whole media gateway MGW1 connection can be through connected with one DCP, Through connect (Pi1, Po1) message.

8.   ISDN, Initial Address Message IAM (MGW1, Pv11, OPC, DPC, CIC)

The IAM message is sent from the gateway mobile services switching centre/transit switching centre GMSC1/TSC to the mobile services switching centre MSC. The

media gateway MGW1 address and Pv11 or optionally the OPC, DPC, CIC can be

used for identifying the incoming connection in the mobile services switching centre

MSC.

9.   DCP, resource request (MGW1, Pv11)

Resources are requested for the call identified by its CIC.

10.   DCP, resource response (Po1)

An outgoing point Po1 is returned from the media gateway MGW1.

11.   DCP, Through connect (Pv11, Po1)

The mobile services switching centre MSC commands the media gateway MGW1 to

link in a transcoder and to through connect the virtual point Pv1 and the outgoing

point Po1. Optionally, the whole media gateway MGW1 connection can be through

connected with one DCP, Through connect (Pi1, Po1) message.

12.   RANAP, Paging

13.   DTAP, Paging Response

14.   DTAP, Set-up

15.   DTAP, Call confirmed

16.   RANAP, Assignment Request

17.   AAL2, Establish Request

18.   AAL2, Establish confirm

19. RANAP, Assignment Response

20. DTAP, Alert

21. ISDN, Address Complete Message ACM

22. ISDN, Call Proceeding CPG

23. DTAP, Connect

24. DTAP, Connect ack

25. ISUP, Answer Message ANM

26. ISUP, Answer Message ANM

27. ISDN, Initial Address Message IAM (OPC, DPC, CIC)

Call set-up is requested from an external ISDN network for a mobile terminated call

attempt. In this example the gateway mobile services switching centre GMSC2 and

the Signaling Gateway 2 are collocated.

28. DCP, resource request (MGW2, CIC)

Resources are requested for the call identified by its CIC, which were chosen by the

transit switch 2 of the ISDN network.

29. DCP, resource response (Pi2, Pv11)

An incoming point Pi2 and a virtual point Pv21 are returned from the media gateway

MGW2.

30. MAP, SendRouting Information request

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The gateway mobile services switching centre GMSC2 interrogates the home location register HLR for routing information.

31.   MAP, SendRouting Information response

The gateway mobile services switching centre GMSC2 receives the mobile services switching centre MSC address.

32.   ISDN, Address Complete Message ACM

The ACM message is send from the gateway mobile services switching centre GMSC2 to the transit switch 2.

33.   Optional DCP, Through connect (Pi2, Pv21)

The gateway mobile services switching centre GMSC2 commands the media gateway MGW2 to through connect the incoming point Pi2 and the virtual point Pv21. Optionally, the whole media gateway MGW2 connection can be through connected with one DCP, Through connect (Pi2, Po2) message.

34.   ISDN, Initial Address Message IAM (MGW2, Pv21, OPC, DPC, CIC)

The IAM message is sent from the gateway mobile services switching centre GMSC2 to the mobile services switching centre MSC. The media gateway MGW2 address and Pv21 or optional the OPC, DPC, CIC can be used for identifying the incoming connection in the mobile services switching centre MSC.

35.   DCP, resource request (MGW1)

Resources are requested for incoming AAL2 connection.

36.   DCP, resource response (Pv12, Pi11)

An incoming point Pi11 is returned from the media gateway MGW1.

37.   Optional DCP, Through connect (Pv12, Pi11)

The mobile services switching centre MSC commands the media gateway MGW1

to through connect the virtual point Pv12 and the incoming point Pi11. Optionally,

the whole media gateway MGW1 connection can be through connected with one

DCP, Through connect (Pi11, Po2) message.

38.   RANAP, Paging

39.   DTAP, Paging Response

40.   DTAP, Set-up

41.   DTAP, Call confirmed

42.   DTAP, Alert

43.   ISDN, Address Complete Message ACM

44.   ISDN, Call Proceeding CPG

45.   DTAP, HOLD (B)

46.   DTAP, HOLD ACK

47.   ISUP, Call Proceeding Message CPG (B held)

48.   ISUP, Call Proceeding Message CPG (B held)

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49.   DCP, Set-up connection (MGW1, media gateway MGW2, Pv21, Pi11)

        MSC requests resources for an outgoing AAL2 connection, links in a transcoder and

        commands the media gateway MGW2 to set up a connection towards Pi11 in media

        gateway MGW1.

50.   AAL2, Establish Request

51.   AAL2, Establish confirm

52.   DCP, Set-up connection response (Po2)

        The media gateway MGW2 signals back that the outgoing connection has been set

        up and returns an outgoing point Po2.

53.   DCP, Through connect (Pv21, Po2)

        The mobile services switching centre MSC commands the media gateway MGW2

        to through connect the virtual point Pv21 and the outgoing point Po2. Optional the

        whole media gateway MGW2 connection can be through connected with one DCP,

        Through connect (Pi2, Po2) message.

54.   DCP, Disconnect (Po2, Pv22)

55.   DCP, Through connect (Pv12, Po2)

        The mobile services switching centre MSC commands the media gateway MGW1

        to through connect the virtual point Pv12 and the outgoing point Po2. Optionally, the

        whole media gateway MGW2 connection can be through connected with one DCP,

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Through connect (Pi2, Po2) message. This connects the existing user plane between

the radio network controller RNC and media gateway MGW1 with the user plane of

subscriber C.

56.   DTAP, Connect

57.   DTAP, Connect ack

58.   ISUP, Answer Message ANM

59.   ISUP, Answer Message ANM

60.   DTAP, Build Multiparty

61.   DCP, Link in CCD (MGW1, Po11, Pv11)

       A PCM 64 kbit/s CCD is linked in the path where the user plane is 64 kbit/s.

62.   DCP, Disconnect (Po1, Pv12)

63.   DCP, Link in transcoder (MGW1, Pi11, Pv12)

       To convert speech to PCM.

64.   DCP, Through connect (Pv12)

       Through connect Pv12 and conference bridge.

65.   ISUP, Call Proceeding CPG (Retrieve)

66.   ISUP, Call Proceeding CPG (Retrieve)

67.   ISUP, Call Proceeding CPG (MPTY)

68.   ISUP, Call Proceeding CPG (MPTY)

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69.   ISUP, Call Proceeding CPG (MPTY)

70.   DTAP, Build MPTY ack

Figure 10 illustrates call forwarding in the mobile services switching centre MSC to

an ISDN subscriber identified by an ISDN no. The mobile services switching centre MSC sets up

the connection between media gateway MGW1 and media gateway MGW2.

In this scenario a subscriber A has set up a call over the ISUP to a user equipment B.

For this purpose the TSC1 has set up the context between the terminations Pi1 and Pv11 in media

gateway MGW1 and the mobile services switching centre MSC has set up the context including a

transcoder between the terminations Po1 and Pv11. An assignment request has been sent over the

Iu interface, which has set up the user plane between the UE and the media gateway MGW1. The

mobile services switching centre MSC deducts the transit switching centre TSC2 address and the

media gateway MGW2 address out of the forwarded to number. Then the mobile services switching

centre MSC forwards the user plane from media gateway MGW1 to media gateway MGW2.

Figure 11 illustrates an example involving the CW and HOLD functions. In this

scenario, a subscriber A has set up a call over ISUP to a user equipment B. For this purpose the

TSC1 has set up the context between the terminations Pi1 and Pv11 in media gateway MGW1 and

the mobile services switching centre MSC has set up the context including a transcoder between the

terminations Po1 and Pv11. An assignment request has been sent over the Iu interface, which has

set up the user plane between the UE and the media gateway MGW1. Then a subscriber C sets up

a call over ISUP to user equipment B. For this purpose the transit switching centre TSC2 has set up

the context between the terminations Pi2 and Pv21 in media gateway MGW2. If the active call is to

be put on hold, the user plane has to be disconnected at media gateway MGW1. If the waiting call

is to be accepted the mobile services switching centre MSC sets up the context including a

transcoder between the terminations Po2 and Pv21 in media gateway MGW2.

Figure 12 illustrates MPTY calls, using CCDs only in media gateway MGW3. In this

scenario, a subscriber A has set up a call over ISUP to a user equipment B. Then a subscriber C has

set up a call over ISUP to user equipment B. The user equipment B has accepted the waiting call

from subscriber C and put the active call on hold. If a built MPTY message is received from the UE,

then the mobile services switching centre MSC selects a media gateway with CCD capabilities. The

capabilities are requested by the mobile services switching centre MSC, whenever a new media

gateway is introduced to the MSC server or when a previously introduced media gateway comes

back into service again. The media gateway selection is done according to the following priorities:

an media gateway with the active call on (this saves a subsequent set-up from RNC towards the

MGW); an media gateway with the call on hold call; or any media gateway with CCD capabilities,

chosen depending on the current load situation.

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The above described examples illustrate the new approach to separation of call control and bearer control for implementation of GSM and UMTS core networks. This implementation provides the features summarized above and set forth in the following claims.

CLAIMS

1.   A method of setting up a call in a wireless communication network with separation of call control and bearer control comprising the steps of:

receiving a service request for a call, the request originating internal to the wireless communication network or external to the wireless communication network, the call being intended for a select destination;

analyzing the service request and the call origin;

selecting at least one media gateway to switch a user plane for handling the call dependent on the result of said analysis; and

communicating with the media gateway to set-up bearer control for the call.

2.   The method of claim 1 wherein the call is from a mobile terminal in the network to a mobile terminal in the network and the selecting step comprises selecting a single media gateway for handling the call.

3.   The method of claim 1 wherein the call is from external to the network to a mobile terminal in the network and the selecting step comprises selecting a single media gateway for handling the call.

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4. The method of claim 1 wherein the call is from external to the network and the select destination is external to the network and the selecting step comprises selecting a first media gateway and a second media gateway for handling the call.

5. A method according to any of the claims 1 to 4, wherein the media gateway is selected from among a plurality of media gateways dependent on media gateway capabilities required for handling the call.

6. A method according to any of the claims 1 to 5, wherein the media gateway is selected from among a plurality of media gateways dependent on a selected destination for the call.

7. A method according to any of the claims 1 to 6, wherein the call is from a mobile terminal in the network to external to the network and the selecting step comprises selecting a single media gateway for handling the call.

8. A method according to any of the claims 1 to 7, wherein the selecting step comprises selecting a group of media gateways according to the select destination of the call and the at least one media gateway is selected from the group of media gateways according to capabilities of the at least one media gateway.

9.   The method of claim 8 wherein the at least one media gateway is further selected based on traffic load of the at least one media gateway.

10.   A method according to any of the claims 1 to 9, wherein an MPTY call is established by selecting an media gateway preferring the media gateway serving the active call, and if said media gateway serving the active call cannot be used, the media gateway serving the held call, and if the media gateway serving the held call cannot be used, an media gateway with MPTY capabilities selected based on traffic conditions.

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11.   A method of setting up a call in a wireless communication network with separation of call control and bearer control comprising:

a) initiating call set-up over one control node, the one control node determining a media gateway (MGW) for routing a user plane of the call;

b) the one control node requesting resources from the media gateway for handling the call;

c) the one control node transferring an address for the media gateway in a forward direction to a further control node;

d) the further control node implementing steps b) and c) until either a call destination or an external network is reached, the call being carried through the network, whereby call control is implemented in the control nodes and bearer control is implemented in the media gateway.

12.   A method according to claim 11 wherein the one control node selects the media gateway for handling the bearer control of the call.

13.   A method according to claim 11 or 12, wherein the further control node is one of a gateway mobile services switching centre.

14.   A method according to claim 11 or 12, wherein the further control nodes are a gateway mobile services switching centre and a second mobile services switching centre.

15.   A method according to claim 11 or 12, wherein the one control node is a Transit Switching Centre.

16.   A method according to any of the claims 11 to 15, wherein the media gateway reserves a logical point identifying reserved resources in the media gateway for handling the call in response to a request for resources.

17. The method of claim 16 wherein the step c), the one control node transferring an address for the media gateway in a forward direction to a further control node, further comprises transferring an identification of the logical point in the forward direction to the further control node.

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18. A wireless communication network comprising:

plural control nodes, the control nodes receiving information about a call, the control nodes requesting resources from at least one media gateway (MGW) for handling a user plane of the call; and

the at least one media gateway including plural logical points for connecting plural media gateway resources for handling the user plane of the call, the at least one media gateway being adapted to identify one of the logical points to one of the control nodes in response to a request for resources from the one of the control nodes,

whereby the plural control nodes use the at least one media gateway for handling the user plane of the call.

19. A wireless communication network according to claim 18 wherein at least one of the plural media gateway resources is one of a transcoder, a conference call device, a modem, a tone generator, a framing device or an announcement device.

20. A wireless communication network according to claim 18 or 19, wherein the communication between control nodes and the at least one media gateway regarding the control and reservation of resources in said at least one media gateway is performed using a Device Control Protocol.

21.   A wireless communication network according to claim 18, 19, or 20, wherein

the Device Control Protocol is H.GCP.

22. A wireless communication network according to any of the claims 18 to 21,

wherein the control nodes request resources from one of the media gateways in response to the

information being a service request for the call.

23. A wireless communication network according to any of the claims 18 to 22,

wherein each media gateway includes plural logical points for connecting plural media gateway

resources for handling the call, the media gateway being adapted to identify one of the logical points

to one of the control nodes in response to a request for resources from the one of the control nodes.

24. A wireless communication network according to any of the claims 18 to 23,

wherein the identified logical point identifies a reserved resource and is returned to the control server

using H.GCP.

25. A wireless communication network according to any of the claims 18 to 24,

wherein the network uses an N-ISUP interface between the control nodes for call control signaling.

26. A wireless communication network according to any of the claims 18 to 25,

wherein the user plane is transferred compressed within and between media gateways.

27. A wireless communication network comprising:

at least one media gateway (MGW), each media gateway being adapted for routing a user plane of a call and each including media gateway resources for handling the call; and

at least one control node, the at least one control node implementing application logic for call control, the application logic requesting media gateway resources from the at least one media gateway for handling a call to allow pooling of media gateway resources under control of the application logic.

28. A wireless communication network according to claim 27, further comprising an interface for signaling for media gateway control between the at least one media gateway and the at least one control node.

FIG. 1
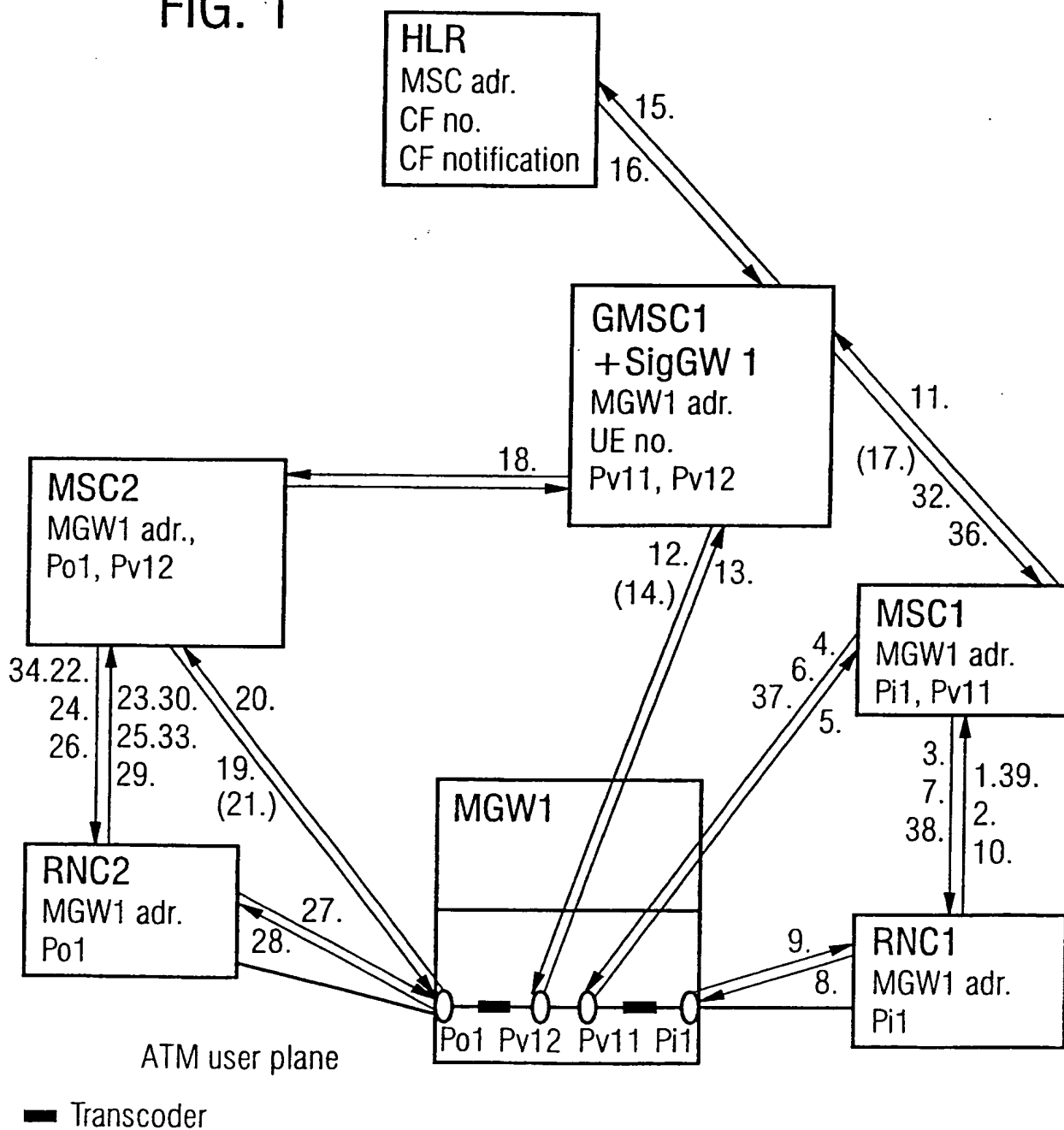
FIG. 2
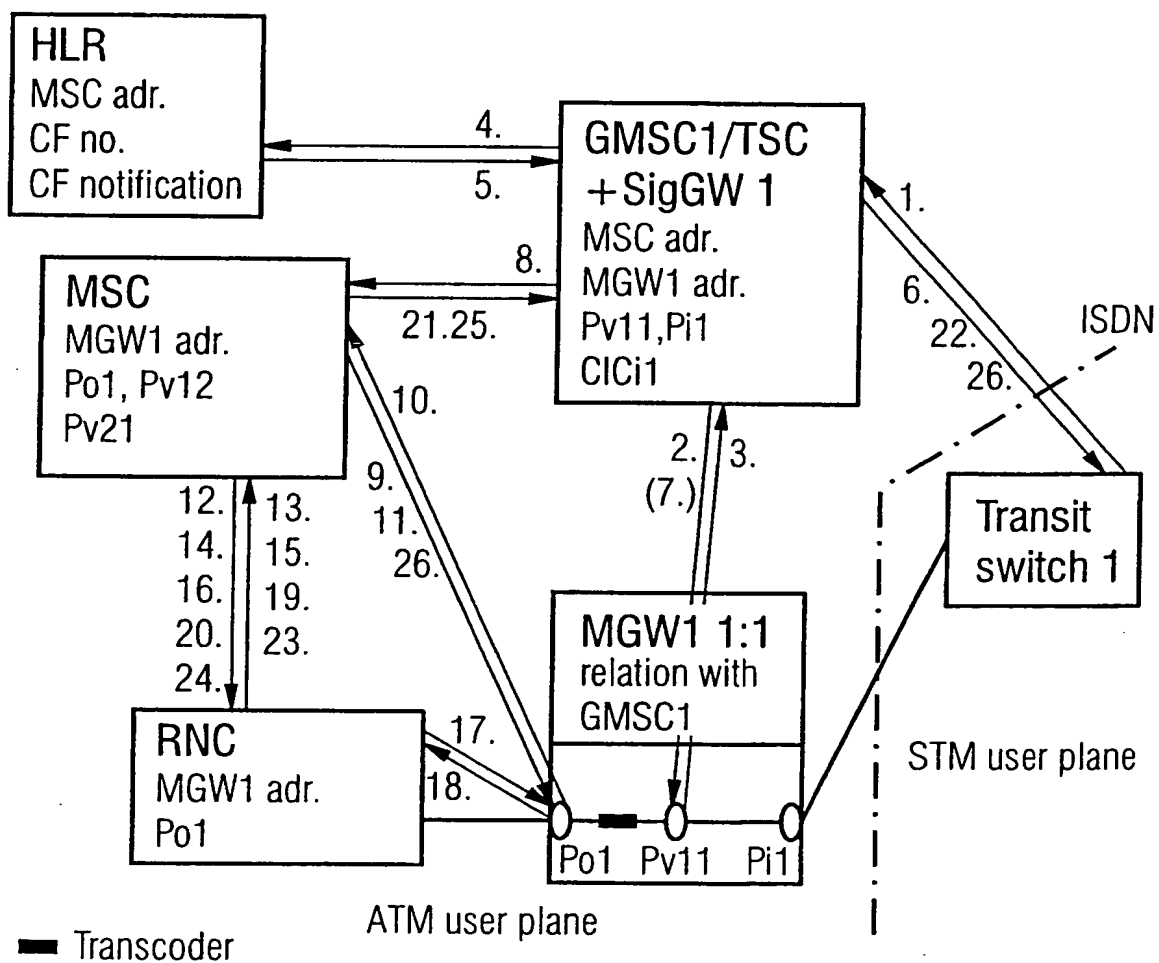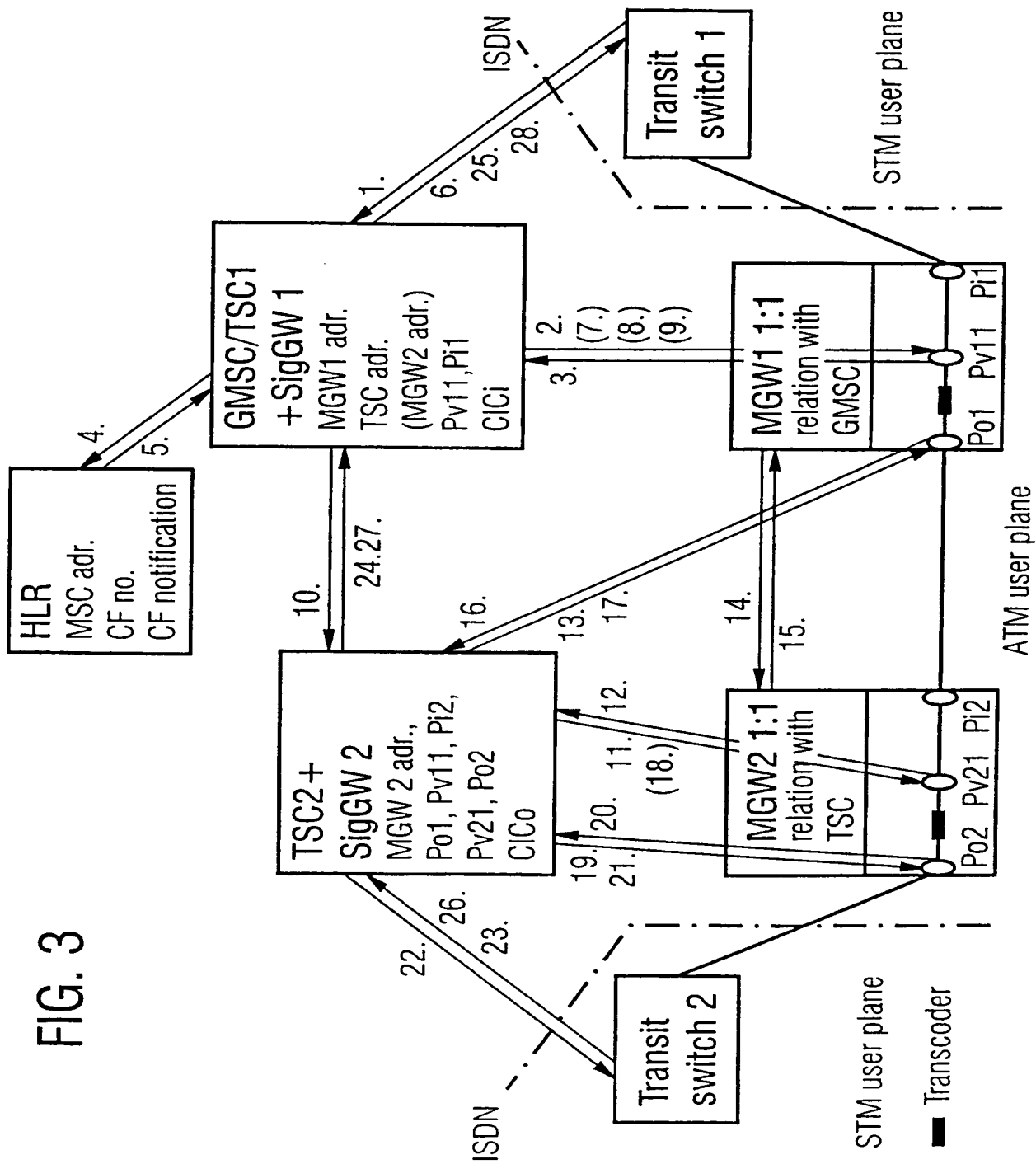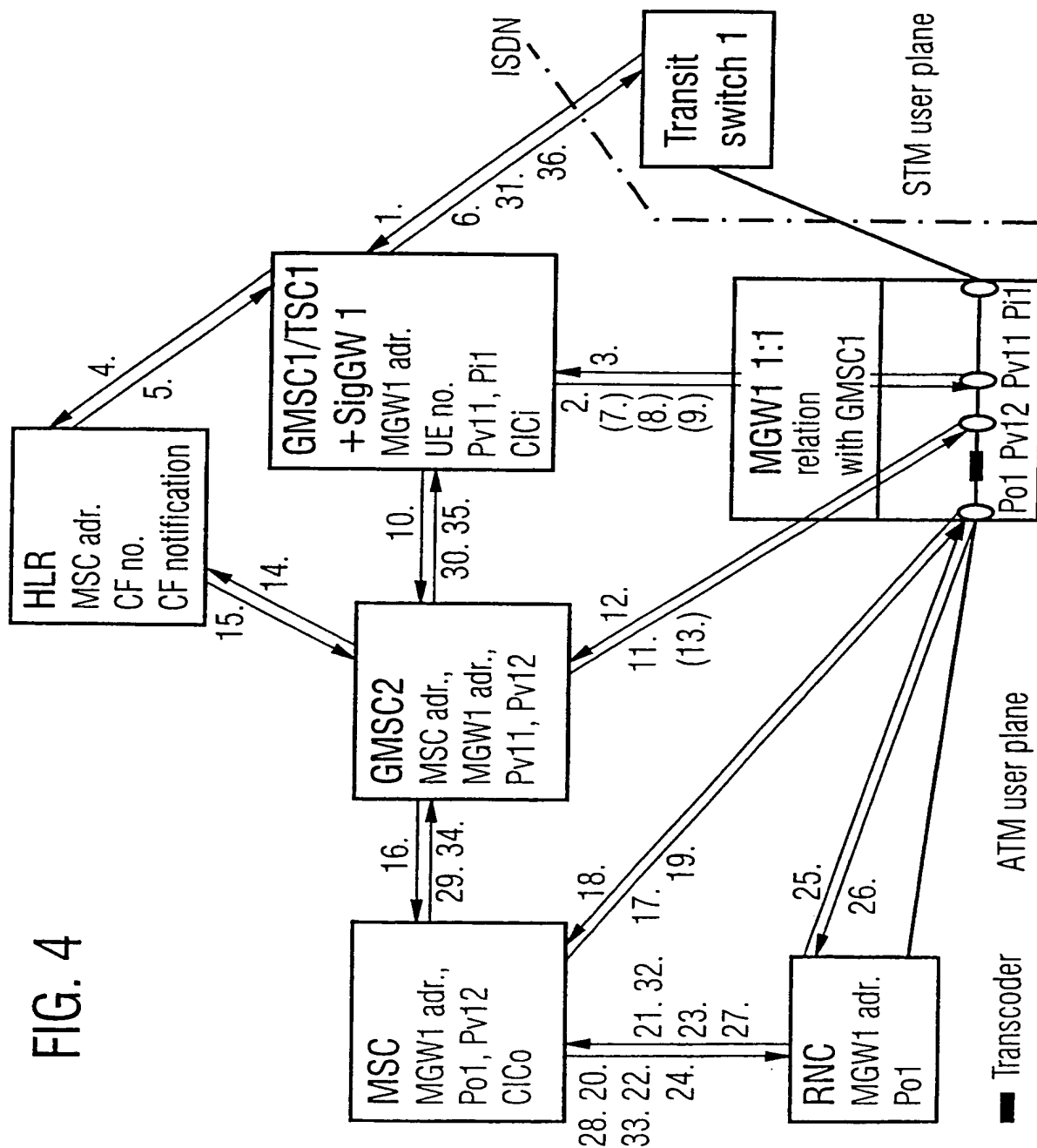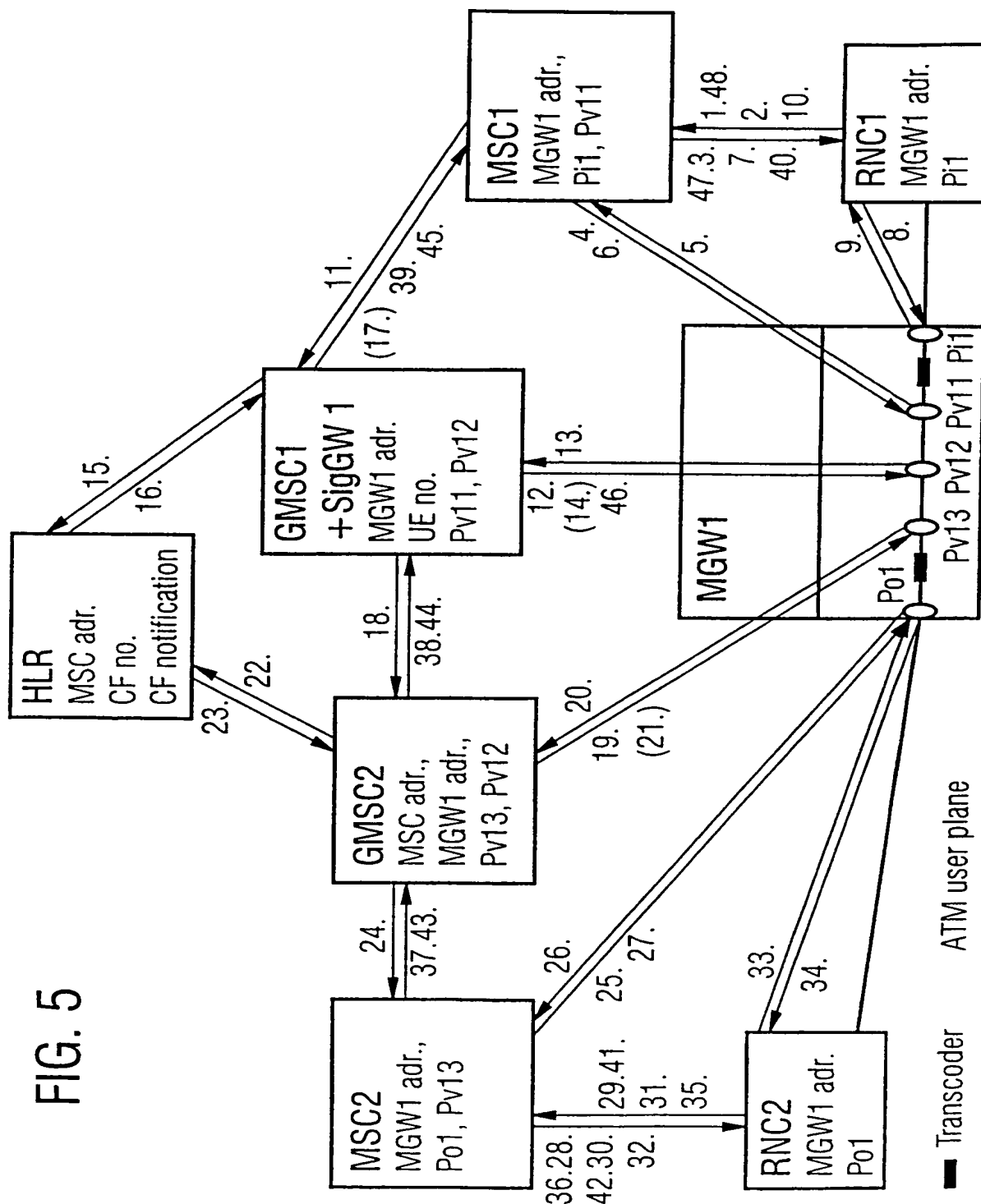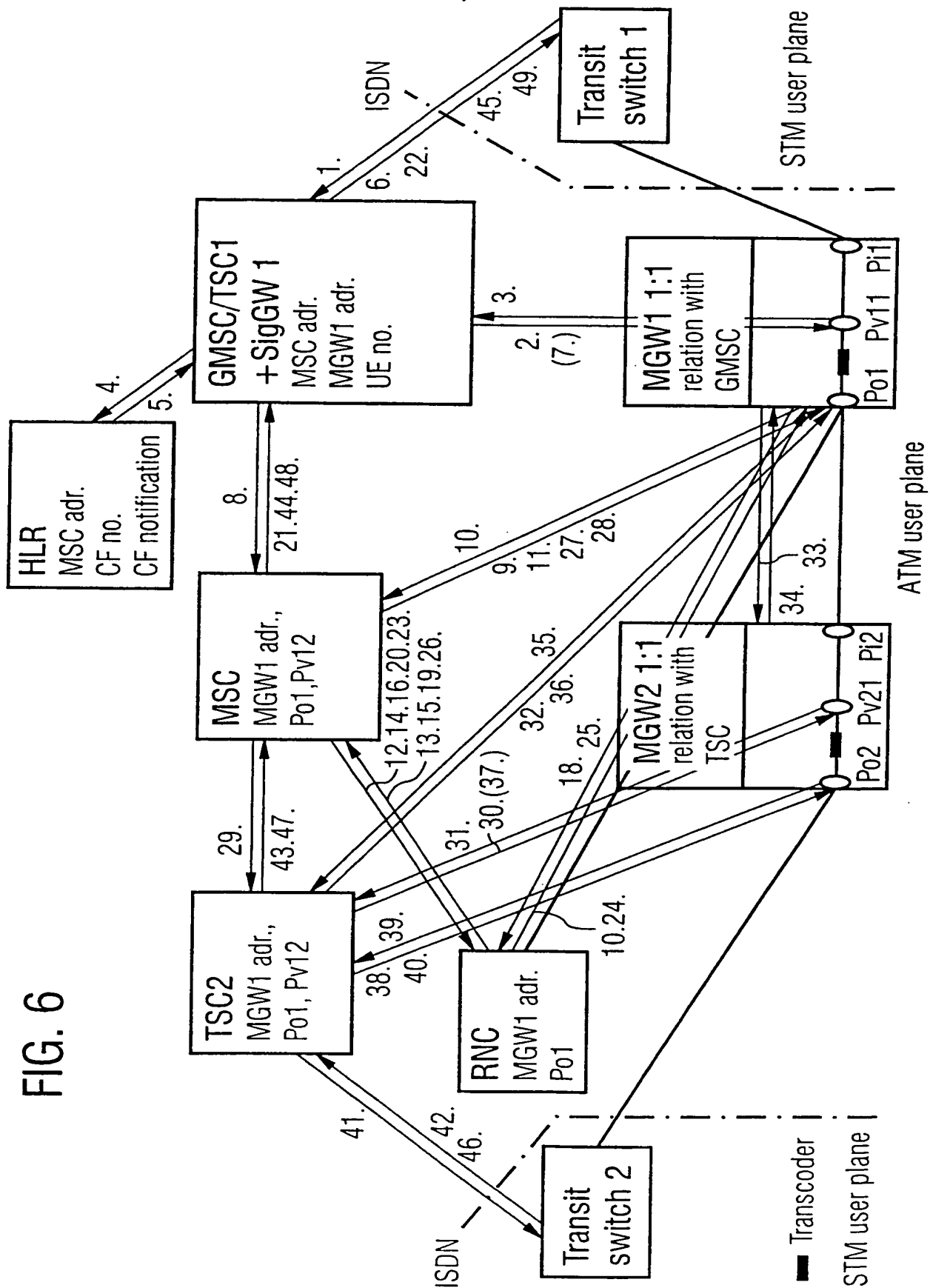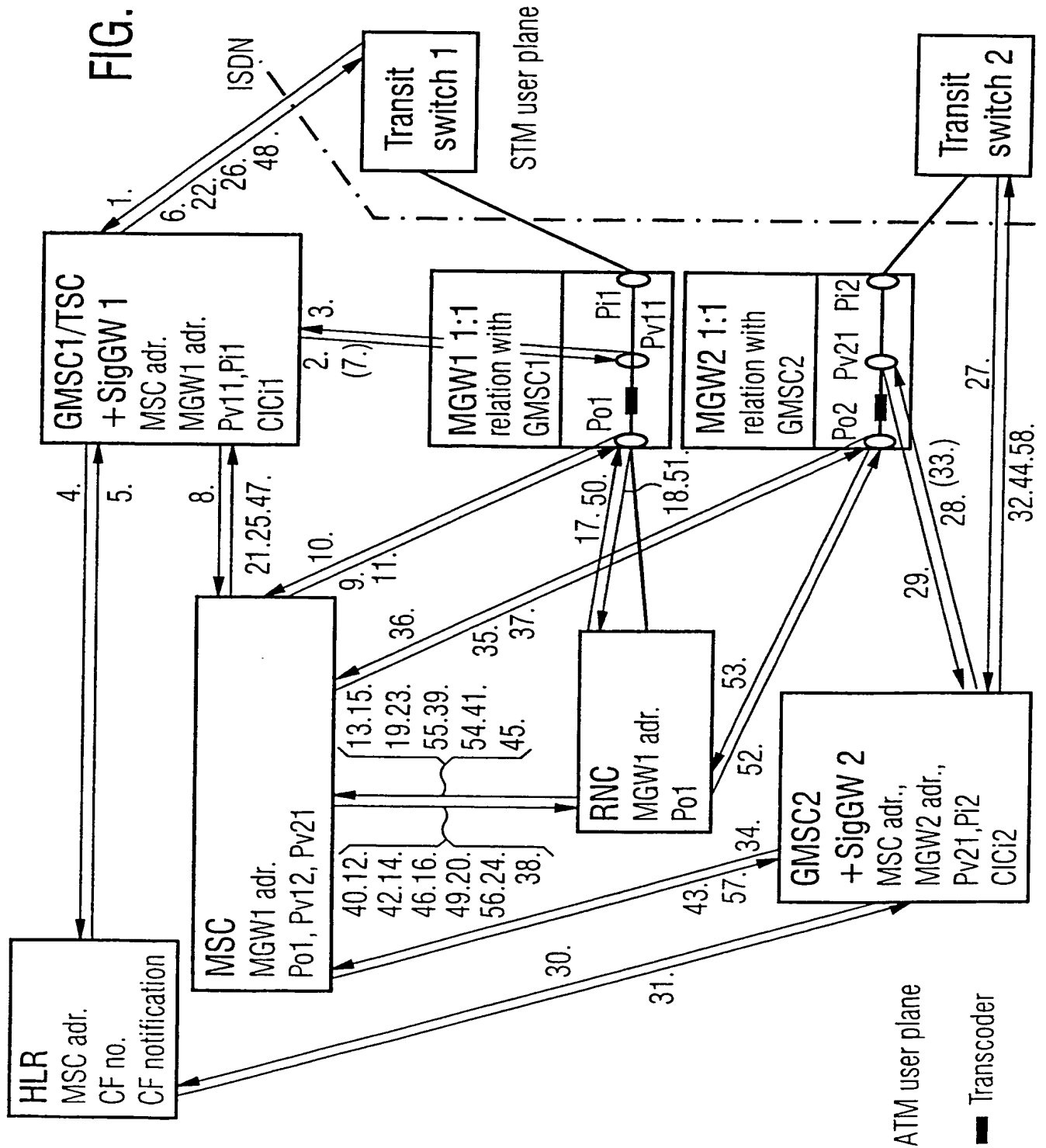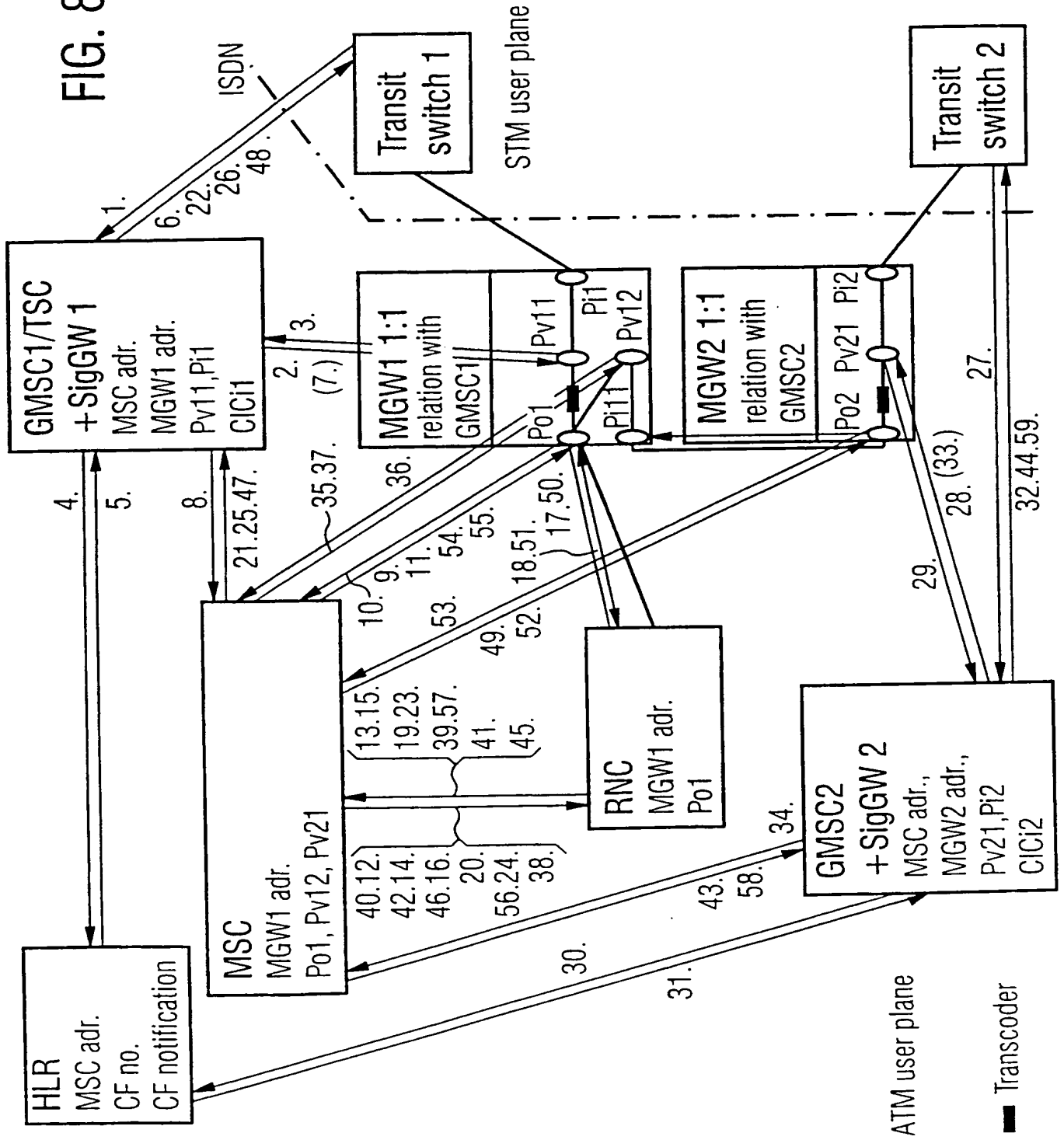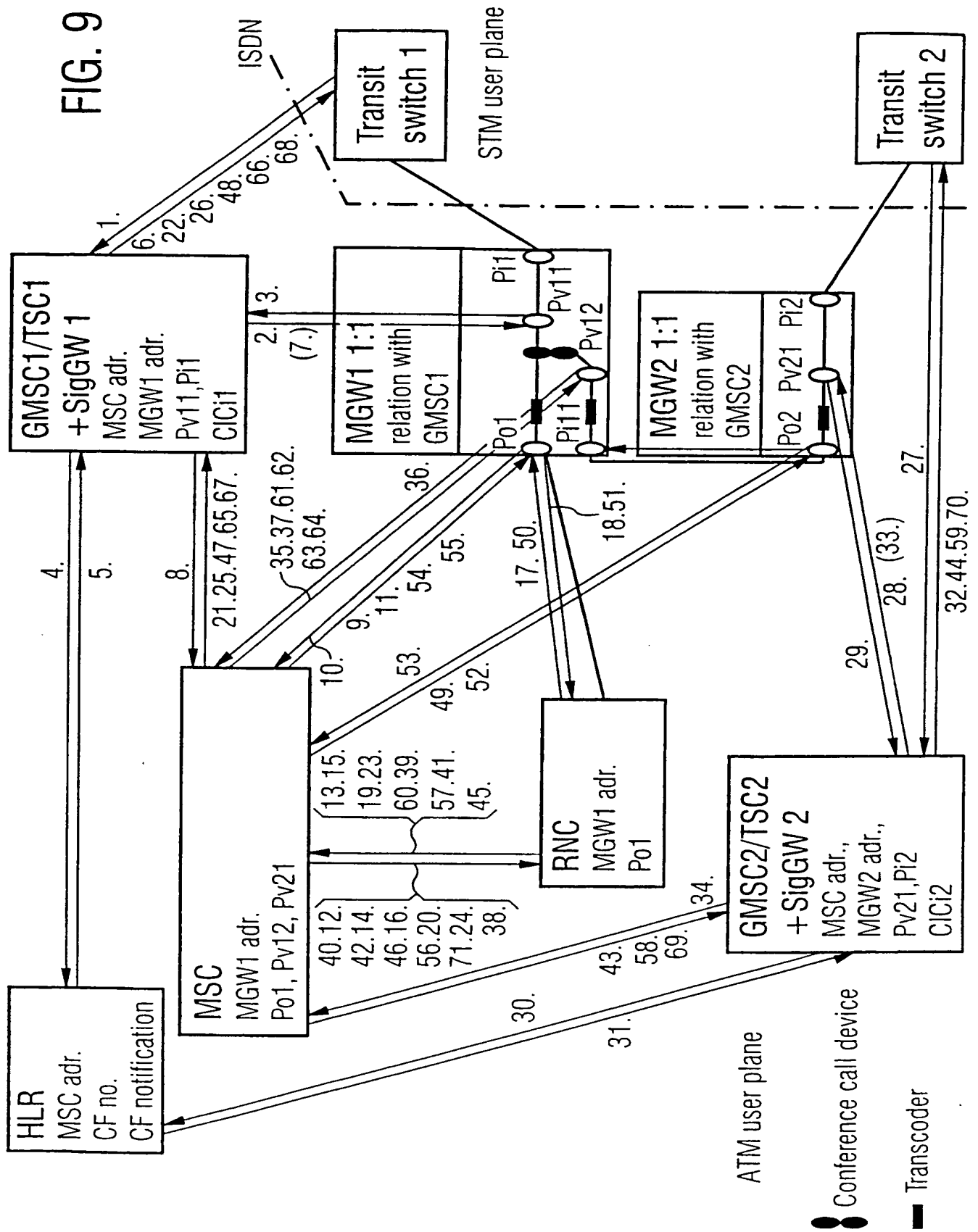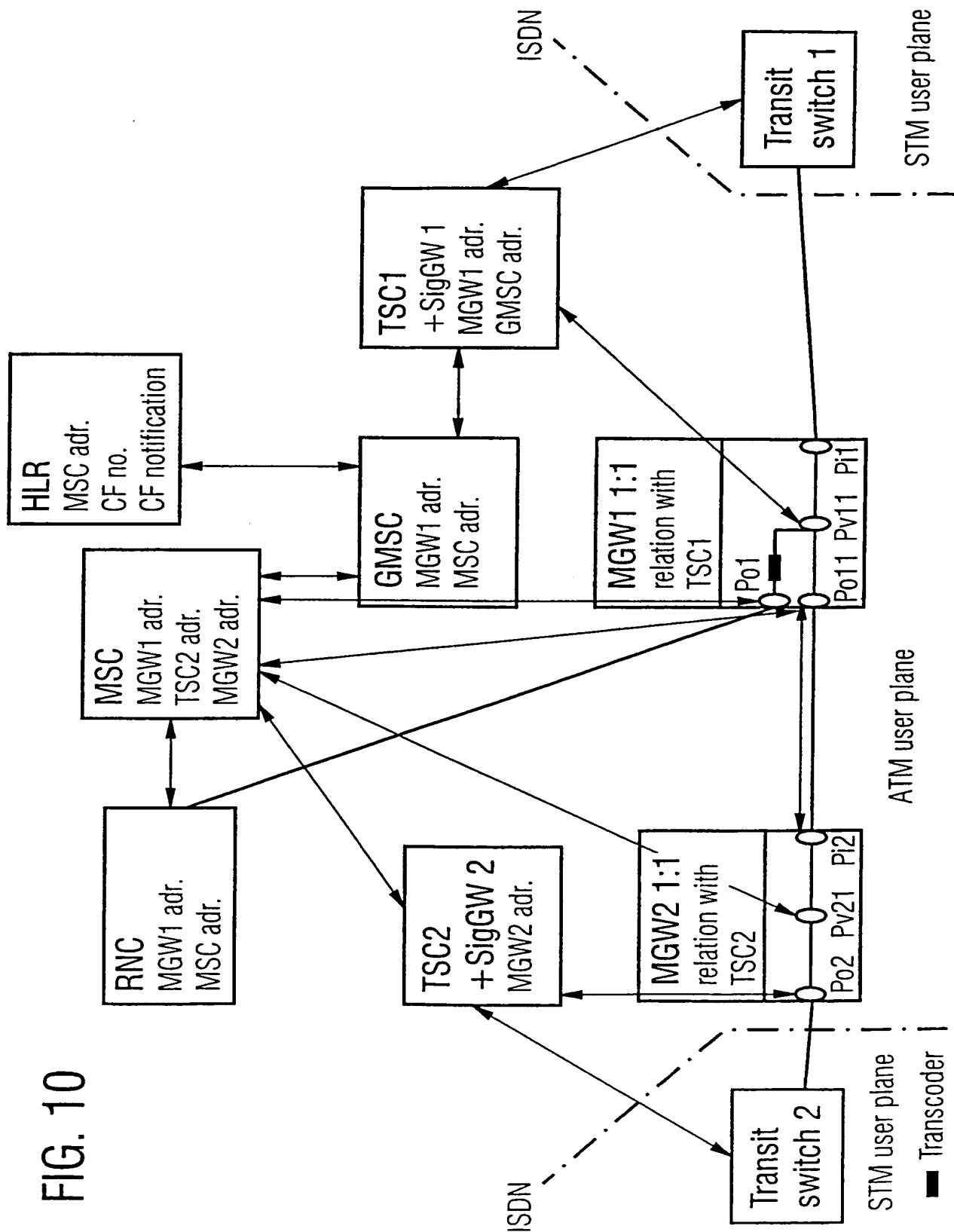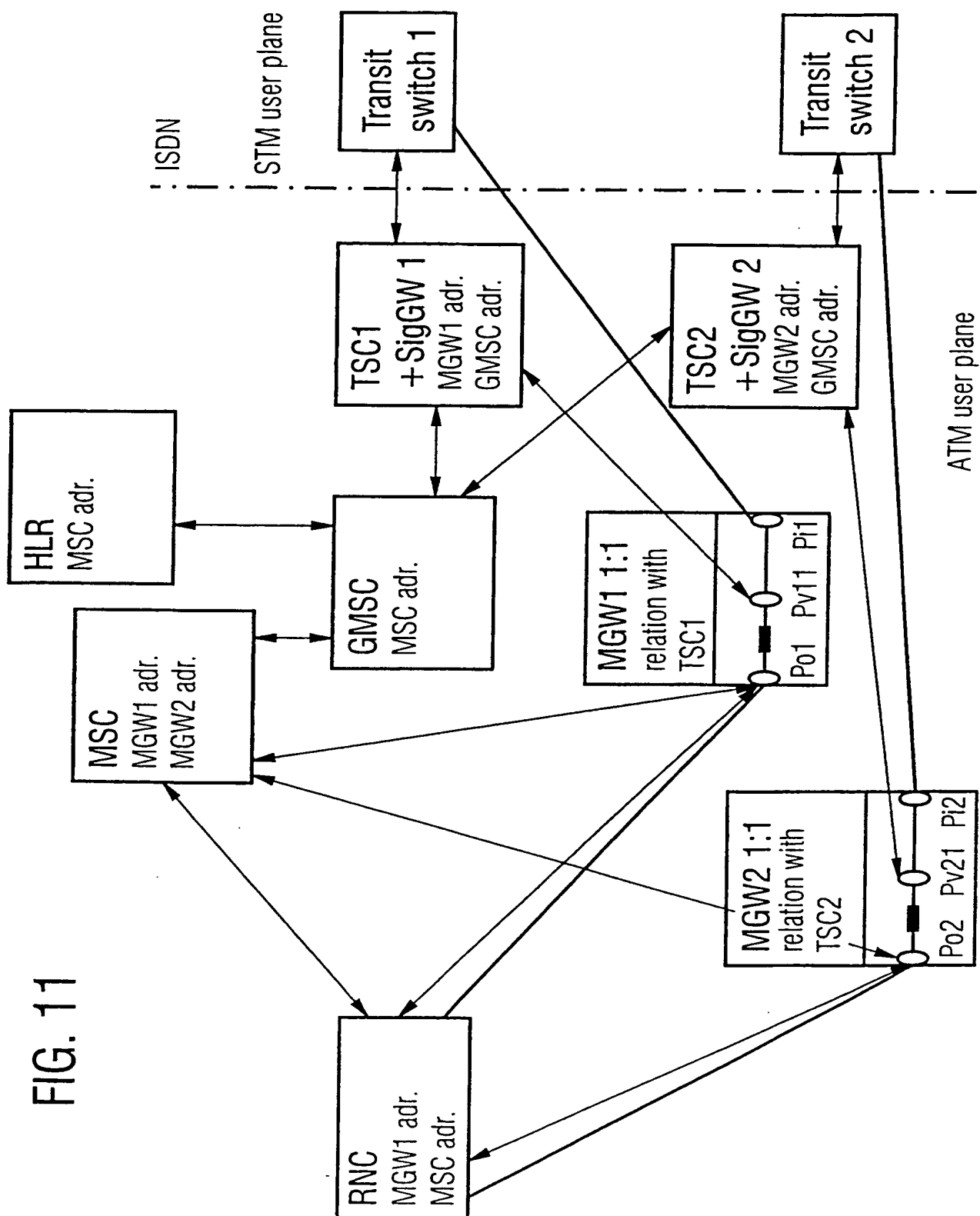

```
HLR
MSC adr.
CF no.
CF notification
```

4.
5.

```
GMSC1/TSC
+SigGW 1
MSC adr.
MGW1 adr.
Pv11,Pi1
CICi1
```

1.
6.
22.
26.

ISDN

```
MSC
MGW1 adr.
Po1, Pv12
Pv21
```

8.
21.25.

10.
9.
11.
26.

2. 3.
(7.)

```
Transit
switch 1
```

12.
14.
16.
20.
24.

13.
15.
19.
23.

```
MGW1 1:1
relation with
GMSC1
```

STM user plane

```
RNC
MGW1 adr.
Po1
```

17.
18.

Po1   Pv11   Pi1

ATM user plane

■ Transcoder

FIG. 3

FIG. 4

FIG. 5

FIG. 6

FIG. 7

FIG. 8

FIG. 9

FIG. 10

FIG. 11

FIG. 12
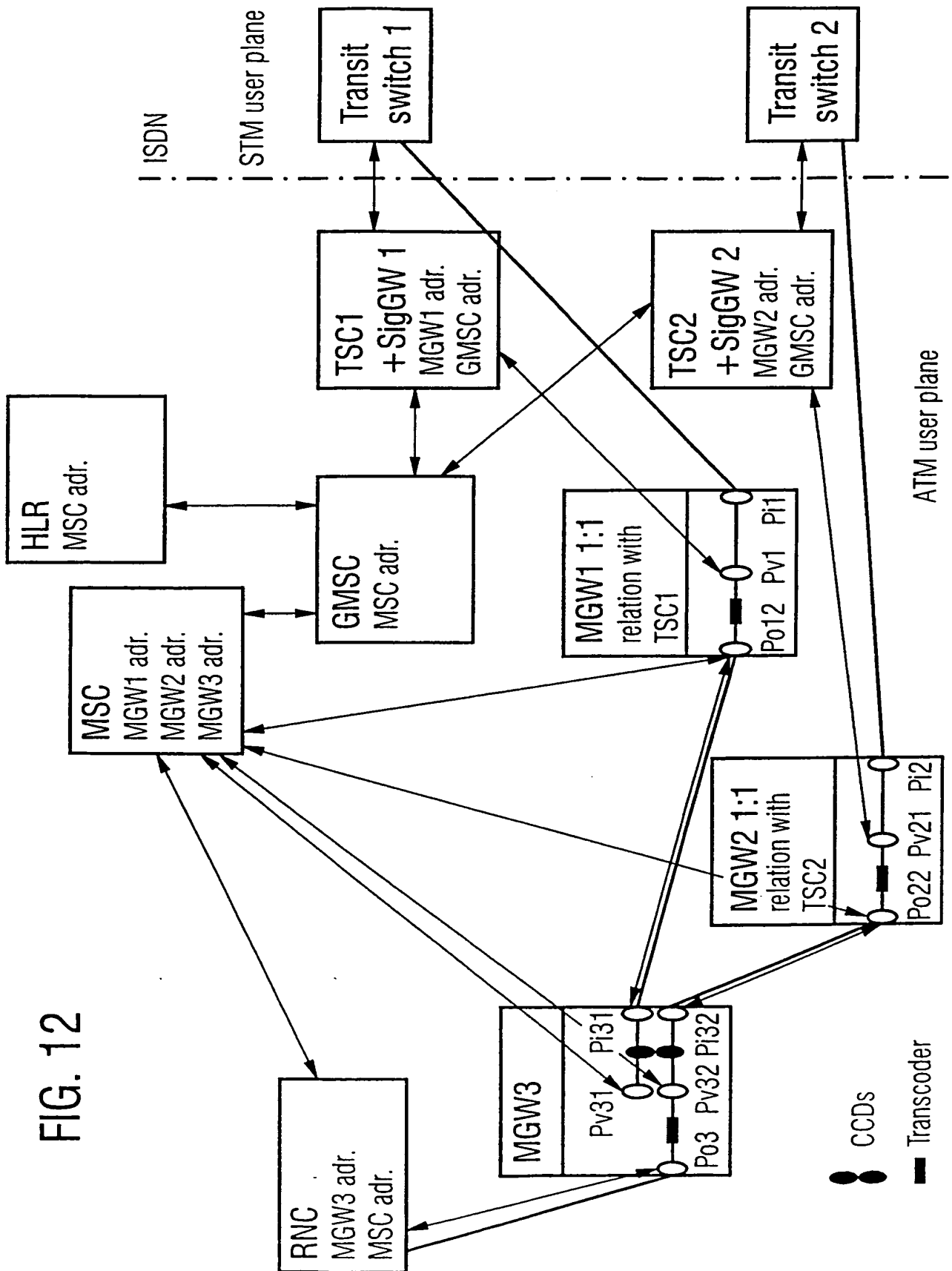
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   H04Q7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC

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A	KNIGHT R R ET AL: "THE CALL CONTROL PROTOCOL IN A SEPARATED CALL AND BEARER ENVIRONMENT" BT TECHNOLOGY JOURNAL,GB,BT LABORATORIES, vol. 16, no. 2, 1 April 1998 (1998-04-01), pages 75-86, XP000750520 ISSN: 1358-3948 page 75, right-hand column, line 1 -page 77, right-hand column, line 46 page 82, left-hand column, line 1 -page 85, left-hand column, line 5	1,11,18, 27

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[X] Further documents are listed in the continuation of box C.   [X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 October 2000	07/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Lõpez-Pérez, M–C

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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E	EP 1 039 767 A (ERICSSON TELEFON AB L M) 27 September 2000 (2000-09-27) column 1, line 53 -column 3, line 30 column 4, line 1 -column 5, line 17 column 6, line 7 -column 12, line 20 —————	1-20,22, 23,27,28

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